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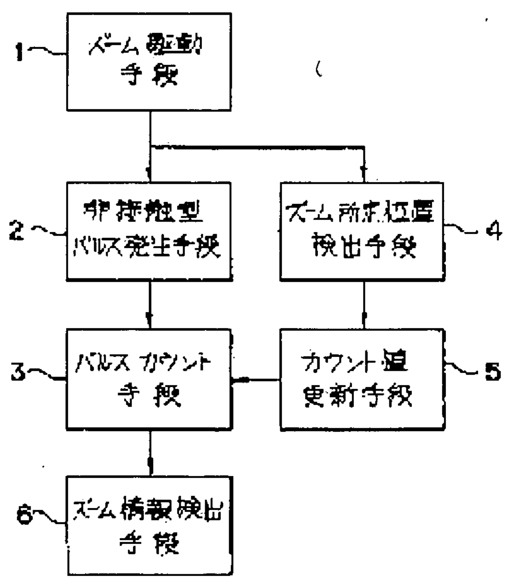
(54) ZOOM ENCODER

(57)Abstract:
PURPOSE: To nearly eliminate the defect of a relative value encoder in terms of principle in practical use with comparatively simple constitution without making the constitution of a zoom encoder large by making an absolute value encoder non-contact and without causing the increase of cost.
CONSTITUTION: This zoom encoder detects the turning amount and the turning direction of a cam ring which turns around the optical axis of a photographing optical system so as to change the focal distance of the photographing optical system. Then, it is provided with a non-contact type pulse generating means 2 which generates a pulse signal in accordance with the turning of the cam ring being a zoom driving means 1, a pulse counting means 3 which adds or subtracts the pulse signal in accordance with the turning direction of the cam ring, a position detecting means (zoom specified position detecting means) 4 which detects a specified position signal at least near the wide angle end and the telephoto end in the focal distance, a counted value changing means 5 which changes the counted value by the counting means 3 to a specified value in accordance with the change of the output from the means 4, and a zoom information detecting means 6 which obtains zoom information based on the output from the means 3.



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CLAIMS

[Claim(s)]

[Claim 1] The zoom encoder which detects the amount of rotation and the rotation direction of the cam ring to which the focal distance of photography optical system is changed by rotating around the optical axis of the photography optical system characterized by providing the following. A non-contact type pulse generating means to generate a pulse signal according to rotation of the above-mentioned cam ring. A count means to respond in the rotation direction of the above-mentioned cam ring, and to add or subtract the above-mentioned pulse signal. A position detection means to detect a position signal in near a wide angle edge and near a tele edge a focal distance at least. A counted value change means to change the counted value of the above-mentioned count means into a predetermined value according to change of the output of this position detection means.

[Claim 2] The above-mentioned position detection means is a zoom encoder according to claim 1 further characterized by detecting the predetermined mid-position in the staging area of the wide angle edge of the above-mentioned focal distance, and a tele edge.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to a zoom encoder and the zoom encoder used for the focal distance detection equipment of zoom photography optical system, such as a camera, in more detail.
[0002]
[Description of the Prior Art] As everyone knows, the zoom encoder which detects the amount of rotation and the rotation direction of the cam ring to which the focal distance of photography optical system is changed is used for the focal distance detection equipment of the zoom photography optical system in a camera etc. by rotating around the optical axis of photography optical system.
[0003] In order to detect the rotation position of the cam ring which performs zooming by rotation, this zoom encoder forms a several bits code board, contacts a brush to this code board, and it is made to detect the rotation position of a cam ring. It has the following faults, although there is an advantage that the detection means of a rotation position with this code board can detect the rotation position of a cam ring as bit information from a code board. That is, the manufacturing cost of 1 code board is high.
2) Since bit information has been acquired by contact of a code board and a brush, the defective continuity by oxidization of a code board front face and a brush side occurs with time.
3) The defective continuity by the shortage of contact pressure, surface wear, etc. occurs with time.
It will say that a defect occurs that a defect occurs with time like especially the above 2 and 3 among such faults, after crossing to a user's hand, and it poses a very serious problem on the quality of a product.
[0004] Therefore, in order to solve the fault of the above 2 and 3 fundamentally, it is possible to change into a non-contact type absolute value encoder like the magnetic formula which used optical or MR element etc. which used a zoom encoder of a contact process which was mentioned above for the photograph reflector etc. However, this means has the space of an encoder, and a conversely large demerit on cost. At most 2 - the triplet of expanding and the more it being thought that it is possible practically, the more this demerit enlarges resolution of a zoom encoder are limitations.
[0005] Then, a means to ask for the rotation position of a cam ring is proposed by preparing the optical pulse generator which answers the rotation of a cam ring which performs zooming using the zoom encoder of the conventional contact process, and generates a pulse, and counting up or counting down the pulse output from this generator according to the hand of cut of the cam ring for zoom as indicated by JP,2-5130,U. According to this means, the zoom encoder of a high resolution can be obtained only with one photo interrupter.
[0006]
[Problem(s) to be Solved by the Invention] However, the rotation position detection equipment using the zoom encoder indicated by above-mentioned JP,2-5130,U is the so-called relative-value encoder, and since it is not an absolute value encoder in a digital code like before, it has the following troubles theoretically.
(1) When a mistake count occurs by the incorrect pulse generated in the chatter ring of a pulse generator etc., it remains making a mistake, even if it changed the zoom state. Especially, in a non-contact type pulse generator, since an incorrect pulse occurs in the during starting of a zoom motor well, while making it carry out both-way movement of the zoom ring several times, a mistake count will be accumulated by it and it will have a serious bad influence for exposure and bit information as a result on it.
(2) Although the zoom value changed when the user pushed in or pulled the lens barrel, for example since the monitor of the output of a pulse generator was not necessarily carried out always, in the case of a camera etc., it cannot be detected, but after the zoom value has differed from the actual state, photography will be carried out to it, and it will have a serious bad influence for exposure and bit information as a result on it.
[0007] The purpose of this invention is to offer the non-contact type zoom encoder which is comparatively easy composition and is the theoretic fault which a relative-value encoder has and which can almost abolish practically the probability of occurrence of the trouble of the above (1) and (2), without causing enlargement of the composition by making non-contact the above-mentioned conventional absolute value encoder, and a cost rise.
[0008]
[Means for Solving the Problem] In the zoom encoder which detects the amount of rotation and the rotation direction of the cam ring to which the focal distance of photography optical system is changed by rotating around the optical axis of

photography optical system as the encoder by this invention is shown in the conceptual diagram of drawing 1 O A non-contact type pulse generating means 2 to generate a pulse signal according to rotation of the above-mentioned cam ring which is the driving means 1 to which the focal distance of photography optical system is changed, With a count means 3 to respond in the rotation direction of the above-mentioned cam ring, and to add or subtract the above-mentioned pulse signal, it sets near a wide angle edge and near a tele edge a focal distance at least. A position detection means 4 to detect a position signal, and a counted value change means 5 to change the counted value of the above-mentioned count means 3 into a predetermined value according to change of the output of this position detection means 4, It is characterized by providing a zoom information detection means 6 to acquire zoom information by the output from the above-mentioned count means 3.

[0009]

[Function] If the mid-position of a zoom moving range is arrived at, the counted value of a count means will be updated regardless of the number of pulse counts till then by the counted value corresponding to the exact focal distance.

[0010]

[Example] Hereafter, the example of illustration explains this invention.

[0011] Drawing 2 shows the 1st example of this invention, and this zoom encoder 10 is applied to the zoom lens lens barrel of a camera.

[0012] The zoom encoder 10 formed in the rotation ring 20 consists of three of the fields C exceeding the collapsing section A, the photography range section B, and tele end position, as shown in drawing 3 , among these silver or white with the high A section and C section, and the B section of a reflection factor serve as low black of a reflection factor. Furthermore, among drawing of drawing 2 , the above-mentioned rotation ring 20 rotates in the direction shown by sign A or I, and drives a zoom lens. And the output signal of the zoom photograph reflector 11 (ZPR) fixed to the position in the main part of a camera changes with rotation of this zoom encoder 10. Namely, when the above-mentioned photograph reflector 11 has met the position of alpha shown in drawing 3 , it is a collapsed state, and when this photograph reflector 11 has met the position of beta and the position of a wide state and gamma is met, it is in a tele state.

[0013] The zoom drive unit 30 The zoom motor 31 and the slowdown reduction-gear train 32, The slit 33 which is prepared on axial extension of the above-mentioned zoom motor 31, is interlocked with this zoom motor 31, and is rotated, The zoom photo interrupter 34 (ZPI) which is arranged near this slit 33 and generates an output signal according to rotation of this slit 33, It consists of output reduction gears 35 which gear to the last reduction gear of the above-mentioned slowdown reduction-gear train 32, gear with the drive reduction gear 21 prepared in the periphery of the above-mentioned rotation ring 20, and transmit the rotation force of the above-mentioned zoom motor 31 to the rotation ring 20.

[0014] In addition, the above-mentioned photograph reflector 11 and the outgoing end of a photo interrupter 34 are connected to CPU101 (refer to drawing 4) mentioned later, and CPU101 detects the present focal distance based on the output signal of this photograph reflector 11 and a photo interrupter 34.

[0015] Drawing 4 is the block schematic diagram of the zoom camera with which **** 1 example is applied.

[0016] In drawing, CPU101 is a microcomputer which controls operation of the above-mentioned whole zoom camera, and manages LCD [the sequence control of this zoom camera operation, auto-focusing / auto exposure (henceforth AF/AE) operation, A/D conversion,] / Light Emitting Diode control, and a switch input control.

[0017] the LCD panel 102 -- the piece of a film -- it is the liquid crystal display board which displays a number, a battery check result, etc., respectively

[0018] 1st step switch 1R which the switch control unit 103 operates when half-push [release **], and locks AF and AE, When turned on with 2nd step switch 2R for shutter release which operates when all push [release **], switch Z-UP for a zoom rise, and switch Z-DOWN for a zoom down The power-on switch POWER which the above CPU 101 displays on the above-mentioned LCD panel 102, and changes the whole zoom camera into the state which can be photoed It consists of a switch RW for compulsive rewinding [which performs rewinding under photography], and a back lid-open close switch BK which winds having shut the back lid rapidly by detecting.

[0019] Moreover, light emitting diode (IRED) and a sign 123 show a position sensor (PSD), and, as for a sign 124, IC (AFIC) for AF ranging in the inside of drawing and a sign 105 and a sign 122 show a photographic subject. The above AFIC105 floodlights infrared light for a photographic subject 124 based on the control signal from the above CPU 101, and ranges by detecting the reflected light by PSD123. And the obtained ranging data are transmitted to CPU101 through a serial data bus.

[0020] EEPROM106 is eliminable ROM electrically and has memorized various adjustment values, such as the number of film **, **** correction value stroboscope charge voltage information, and battery check information.

[0021] The stroboscope unit 108 will start charge, if a charge signal is given from the above CPU 101, charge voltage is sent to this CPU101, after A/D conversion is carried out, it is compared with the charge voltage information on EEPROM106, and it is confirmed whether to be the completion of charge.

[0022] The Light Emitting Diode display 109 is a display which tells a photography person about stroboscope luminescence warning, AF lock, etc.

[0023] IF-IC111 is constituted from an IC for an interface by the Light Emitting Diode drive circuit, the circuit which measures the strength of the light by SPD110, the motor drive circuit, the reference voltage circuit, etc.

[0024] Both the signs 112,113 are supplied to this IC112,113 for a drive, after the motorised signal which is IC for motorised and is sent out from the above CPU 101 is once decoded within above-mentioned IF-IC111. And which motor of the above-mentioned zoom motor 31, the AF motor 115, winding up, and the rewinding motor 116 is chosen by the signal of CPU101, and it drives.

[0025] Near the above-mentioned AF motor 115, the photo interrupter 126 which is interlocked with rotation of this motor 115 and generates an output signal is formed, and the above CPU 101 performs rotation control of this AF motor 115 based on the output of this photo interrupter 126.

[0026] Near the above-mentioned winding and the rewinding motor 116, similarly, the photo interrupter 127 which is interlocked with rotation of this motor 116 and generates an output signal is formed, and, as for the above CPU 101, rotation control of this motor 116 is performed based on the output of this photo interrupter 127.

[0027] The above-mentioned zoom motor 31 is controlled by CPU101 based on the output signal of a photo interrupter 34 and the photograph reflector 11, as mentioned above.

[0028] The automatic regulation material 120 is used as a checker at the time of performing AF, AE, battery check, stroboscope adjustment, etc. at works. Each of this data is sent to CPU101 through a serial data bus, and memorizes an adjustment value to the above EEPROM 106.

[0029] The DX code 150 of a film is directly read into CPU101, and is used as an operation value for deciding exposure value.

[0030] A sign 121 is a plunger for sector opening and closing, and a sign 125 is a detecting element which applies reset to CPU101 by the detecting element of a cell voltage at the time of a cell injection and returns of failed voltage.

[0031] Next, an operation of the zoom camera with which **** 1 example is applied is explained with reference to the flow chart shown in drawing 5 - drawing 8 .

[0032] Drawing 5 is the flow chart of the sub routine of the power on reset when supplying a power supply to this zoom camera.

[0033] In drawing, if a cell is inserted or the power switch POWER is switched, power on reset will start CPU101 and operation of a camera will be started. If the sub routine of this power on reset is called, after initial setting of RAM in each port and CPU101 is first performed at Step S101, the check judging of whether the automatic regulation machine 120 was connected to CPU101 will be performed at Step S102. As a result of this check, if the automatic regulation machine 120 is connected to CPU101, it will progress to Step S103 and communication with an external device will be performed. Moreover, if the above-mentioned automatic regulation machine 120 is not connected to CPU101, it progresses to Step S104 immediately, and a dc-battery check is performed. Here, when battery voltage is inadequate, while displaying those without a cell on the LCD panel 102, all camera operation is forbidden.

[0034] Then, in Step S105, after reading predetermined data from EEPROM106, the power switch POWER is checked at Step S106. Here, if the power switch POWER is off, it will progress to Step S120 and the display of the LCD panel 102 will be eliminated, and after the switches BK and RW which perform opening and closing and compulsive rewinding interrupting and granting a permission, it changes into a stop mode state. [of a back swine] If the power switch POWER is ON at the above-mentioned step S106, a zoom lens will be moved to the wide end position which can be photoed from a collapsing position at Step S113. And after progressing to Step S114 and displaying predetermined information on the LCD panel 102, stroboscope charge is performed at Step S115, and it considers as the state which can be photoed.

[0035] At Step S116, the display time to the LCD panel 102 is set to 90 seconds. And if a user operates a certain step, the timer for 90 seconds will be set again. After progressing to Step S118 and permitting interruption of open/close switch BK of a back swine, the rewinding switch RW, and other operation switches (henceforth KEY) to it if it had not passed to Step S119 when it progressed to Step S117, it judged whether 90 seconds passed and 90 seconds had passed, it changes into a halt mode state. When the switch with which interruption was permitted in the above-mentioned stop mode state and the halt mode state is pushed, the sub routine of the standby release shown in drawing 6 is performed.

[0036] Next, the sub routine of this standby release is explained with reference to the flow chart of drawing 6 .

[0037] First, interruption by the back swine switch BK is checked at Step S121. Here, if there is interruption by this back swine switch BK, it will be judged whether it progressed to Step S122 and the back swine has closed. After processing which progresses to Step S124 and opens a back swine at this step S122 if the back swine has not closed is performed, it returns to "1" of drawing 5 . Moreover, if the back swine has closed, after carrying out rapid-winding processing at Step S123, it returns to the above "1."

[0038] At Step S125, it rewinds and interruption by Switch RW is checked. Here, if there is interruption by this rewinding switch RW, it will progress to Step S127 and a film will be rewound.

[0039] Timer interruption is checked at Step S128. If there is timer interruption here, after progressing to Step S134 and performing display timer count processing, the strength of the light is measured at Step S135, and it returns to "2" of drawing 5 . When it is not timer interruption at the above-mentioned step S128, it progresses to Step S129 and film rewinding end or rapid-winding failure is checked. Here, if it is a film rewinding end or rapid-winding failure, it returns to "1" of drawing 5 so that a camera may not operate. Moreover, if it is not a film rewinding end or rapid-winding failure, it will progress to Step S130. If it is ON, the state of the power switch POWER is checked at this step S130, and if off, it progresses to the above "1", and it progresses to Step S131, and continues a main flow as it is.

[0040] The judgment of interruption by Above KEY is performed at the above-mentioned step S131. If after-mentioned each mode switch is pushed and interruption occurs, it will fly to "3" of drawing 7 , and if there is no interruption, it will progress to Step S132.

[0041] At the above-mentioned step S132, if a certain information confirms whether to be under [display] ****** on the LCD panel 102 and does not display [be / it] on it, it progresses to Step S133, interruption of KEY(s), such as each operation switches BK and RW, is permitted, and it will be in a stop mode state. If the LCD panel 102 expresses [be / it] as the

above-mentioned step S132, it returns to "2" of drawing 5 .
[0042] In addition, the switch in the switch control unit 103 indicated to be KEY in Step S117, Step S131, and Step S133 to drawing 4 is meant.
[0043] Next, the sub routine of processing of the above-mentioned KEY interruption is explained with reference to drawing 7 .
[0044] If there is KEY interruption at the above-mentioned step SS 131 (refer to drawing 6), it progresses to Step S141 of drawing 7 , and the LCD panel 102 (refer to drawing 4) is turned on. Then, it is confirmed whether progress to Step S143 and the 1st step of release switch 1R is pushed. If the 1st step of this release switch 1R is pushed, after performing release processing in Step S144, it will return to "1" of drawing 5 . If the 1st step of release switch 1R is off, it progresses to Step S146 at the above-mentioned step S143 and directions of a zoom rise or a zoom down are made, it will progress to Step S158. At this step S158, if the LCD panel 102 confirms whether to be under [display] ****** and displays, if it is not [be / it] under display, it will return to "2" of drawing 5 "4" of drawing 6 again.
[0045] In the above-mentioned step S146, when there are directions of a zoom rise or a zoom down, it progresses to Step S147 and zoom processing is made.
[0046] Next, the step in Step S113 of above-mentioned drawing 5 which moves a zoom lens to the wide end position which can be photoed from a collapsing position is explained in more detail with reference to the flow chart and drawing 10 of drawing 8 .
[0047] In Step S301, after rotating the zoom motor 31 (refer to drawing 4) normally, A/D conversion of the output signal of the above-mentioned photograph reflector 11 (refer to ZPR and drawing 4) is carried out at Step S302. Then, in Step S303, predetermined threshold #TH1 is subtracted from this A/D-conversion value.
[0048] Then, the comparison value in the above-mentioned step S303 is judged (CY), in Step S304, if a borrow does not come out, the above-mentioned A/D value are higher than above-mentioned threshold #TH1, i.e., the output signal of the photograph reflector 11 judges it as "H" level, and it returns to Step S302. If the above-mentioned A/D value become lower than threshold #TH1, it will judge that the output signal of the photograph reflector 11 was set to "L" level, and will progress to Step S305.
[0049] When the output value of the above-mentioned photo interrupter 34 (refer to ZPI and drawing 4) is checked (ZPIHRD) and there is a standup edge at Step S306 by this step S305 after resetting ZMPLS on RAM of the CPU101 interior which shows the current value of a zoom lens, Above ZMPLS is carried out +one.
[0050] Then, since it will be wide end position if it returns to the above-mentioned step S306 and there is no borrow, since it still will not be wide end position if value #WIDE which shows wide end position is subtracted from the current value ZMPLS of a zoom lens, a comparison value is judged in Step S308 (CY) and there is a borrow at Step S307, it progresses to Step S309.
[0051] At this step S309, after applying brakes to the zoom motor 31 (ZMOTBK) and carrying out fixed time standby in Step S310, the zoom motor 31 is stopped in (TI) and Step S311, and it returns to a main routine (Step S312).
[0052] Next, the zoom processing in the above-mentioned step S147 is explained with reference to the flow chart of drawing 9 .
[0053] At a step SS 501, port initialization of CPU101 (refer to drawing 4) required for a zoom motor drive and starting of IFIC111 are performed. Then, in Step S502, if the flag ZUDF which shows the driving direction of the zoom motor 31 (refer to drawing 4) is seen and it becomes this flag ZUDF=1, it will progress to Step S504 so that the zoom motor 31 may be rotated normally. In the above-mentioned step S502, at the time of flag ZUDF=0, it progresses to a step SS 503 so that this zoom motor 31 may be reversed.
[0054] Then, in Step S511, it confirms whether it was turned on any of the zoom switch ZSW, i.e., aforementioned switch Z-UP for a zoom rise and switch Z-DOWN for a zoom down, they are (creatine kinase), and if this zoom switch ZSW is all off, it will progress to Step S516.
[0055] When it is turned on at the above-mentioned step S511 any of switch Z-UP for a zoom rise and switch Z-DOWN for a zoom down they are, it progresses to Step S512.
[0056] At this step S512, it judges whether the zoom position turned into wide end position or tele end position by the above ZMPLS which shows the current value of a zoom lens, and the above-mentioned zoom motor 31 is progressed to the halt way step S516 in the place which became one of the wide end-position and tele end position. Moreover, at the above-mentioned step S512, when the zoom lens position has not reached wide end position or tele end position, next, it progresses to Step S513.
[0057] At this step S513, during the usual zoom operation, although the output signal of the above-mentioned photograph reflector 11 (ZPR) is "L" level, when set to "H" level during a zoom drive, it judges it as an incorrect count and resets Above ZMPLS. Moreover, when the output signal of this photograph reflector 11 (ZPR) is set to "H" level during a zoom down, the zoom motor 31 is rotated normally, and if zoom processing mentioned above is performed, it can reset. Moreover, the pulse for value #TELE which shows tele end position in the place where the output signal of this photograph reflector 11 (ZPR) became "H" level exceeding threshold #TH2 (refer to drawing 11) is counted at the time of a zoom rise, and it resets Above ZMPLS to the pulse number equivalent to tele end position.
[0058] Then, the timer for detection of a photo interrupter 34 (ZPI) is started at Step S514, at Step S515, the pulse standup of this photo interrupter 34 is checked, and Above ZMPLS is counted up or counted down. Here, within fixed time, if there is no standup of this photo interrupter 34, it will be judged as failure of the zoom motor 31 or the zoom encoder 10, and will go to

exception processing (DAMAG) of Step S521.
[0059] If the above-mentioned step S516 judges the above-mentioned flag ZUDF and it becomes ZUDF=0, it will progress to Step S517.
[0060] This step S517 performs backlash **** of a gear by on the other hand driving a mechanism to **. When the zoom motor 31 is normally rotated as an amount of drives and standup 1 pulse of a photo interrupter 34 arises, this motor 31 is suspended.
[0061] Then, fixed time brakes are applied to the above-mentioned zoom motor 31 at Step S518 (ZMMOTB), and after stopping this zoom motor 31 at Step S519, it returns to a main routine (Step S520).
[0062] Drawing 12 shows the 2nd example of this invention, and this zoom encoder 210 is applied to the zoom lens lens-barrel of a camera. The inclination-cam-die slotted hole 213,214 for moving the built-in zoom lens group 211 which consists of pre-group lenses, such as barricade ETA, and back group lenses, such as a compensator, in the direction of an optical axis is drilled by the cam ring 212 which consists of a cam cylinder for a zoom lens drive. The guide pin 216,217 which stood erect in one, respectively is fitted in the pre-group lens maintenance frame and back group lens maintenance frame which are not illustrated at this cam slotted hole 213,214.
[0063] The sector reduction gear 219 for a ring drive is formed for the main part 215 of a camera of the above-mentioned cam ring 212 in the peripheral face of the base approach of ** at one at the hoop direction, and the reduction gear 218 for a drive has geared to this sector reduction gear 219. The turning effort of the output reduction gear 221 of a motor 220 is transmitted to this reduction gear 218 for a drive through a speed reducing gear train 222. Therefore, if the above-mentioned motor 220 is rotated normally or inversion driven, the turning effort will be transmitted to the reduction gear 218 for a drive through a speed reducing gear train 222. this -- a cam ring 212 -- the surroundings of an optical axis -- the right direction or an opposite direction -- rotating -- the above-mentioned cam groove -- by the hole 213,214 and the guide pin 216,217 A pre-group lens maintenance frame and a back group lens maintenance frame move in the direction of an optical axis so that the interval of a pre-group lens and a back group lens may be changed, and zooming of a zoom taking lens is made by this.
[0064] Moreover, to the above-mentioned reduction gear 218 for a drive, the reduction gear 225 for carrying out the rotation drive of the rotor plate 224 for pulse generating of a pulse generator 223 has geared. The above-mentioned pulse generator 223 consists of photo interrupters 226 which consist of the optical irradiation section by which it was countered and arranged in the circumferencial direction on both sides of a part of above-mentioned rotor plate 224 in which the translucent part formed so that a large number might begin to be prolonged in the ****** radiation direction at equal intervals, and the shading section were formed by turns, and this rotor plate 224, and a light sensing portion. Rotation of the reduction gear 218 for a drive which carries out the rotation drive of the above-mentioned cam ring 212 is interlocked with, a rotor plate 224 rotates, and this pulse generator 223 outputs the pulse signals P and I which answer rotation of a cam ring 212 with a photo interrupter 226.
[0065] And the pattern 130 for reading for absolute value encoders is formed in a part of peripheral face of the above-mentioned cam ring 212. This pattern 130 for reading is formed by the pattern of the shape of toothing of the heights of the high reflection factor section, and the crevice of the non-reflecting section, in the **** 2 example, makes the peripheral face of the cam ring itself heights, and forms it by the hole which drilled the crevice in the cam ring. Namely, as the flat-surface configuration is expanded and shown in drawing 13 , this pattern 130 for reading The crevice which the whole configuration becomes a hoop direction from an oblong rectangle, and consists of hole 130a drilled in the left section in the shape of L character, and hole 130b drilled in the method top half section of the right in the shape of an angle hole, It is prepared in the center section and formed by the heights which consist of high reflection factor section 131b formed in the position which forms successively to high reflection factor section 131a and said high reflection factor section 131a which countered the above-mentioned hole 130a and were formed in inverse L-shaped, and counters the above-mentioned hole 130b.
[0066] Thus, it is the position which counters the formed pattern 130 for reading, i.e., the outside of a cam ring 212, and as shown in the position which counters the above-mentioned pattern 130 for reading at drawing 12 , the photograph reflectors 132a and 132b are being fixed to the immobility member which is located in a line in the direction of an optical axis, and is not illustrated. And these photograph reflectors (P. R) 132a and 132b generate the output signals PR1 and PR2 of an absolute value encoder.
[0067] That is, as these photograph reflectors 132a and 132b are shown in drawing 13 , the output signals PR1 and PR2 change [rotation / of a cam ring 212] with ->(1.1) (0.1) ->(0.0) -> (1.0).
Here, standard position (S position) O (0.0) and the changing point of (1.0) are set [the changing point of (1.1) and (0.1) / between collapsing position O (0.1) and (0.0)] up for wide edge (wide angle edge) position O (0.1) and the changing point of (0.0) as tele edge (looking far) position O, respectively. In addition, the zoom lens whose zoom scale factor is 35mm - 80mm in this example shall be used, and it becomes 35mm at a wide edge (W end position), and becomes the focal distance of 80mm at a tele edge (T end position).
[0068] Drawing 14 shows the composition of the important section of the electrical circuit of the camera with which the above-mentioned zoom encoder was applied. Each actuating signal of the power switch PWSW, the switch ZUSW for a zoom rise, and the switch ZDSW for a zoom down inputs, respectively, and in CPU133 which carries out sequence control of zooming operation and photography operation of a camera, CPU133 controls the motor drive circuit 134 by these signals, and controls rotation of the aforementioned drive motor 220 by them to it. And the monitor of the output signals PR1 and PR2 of pulse signal P.I of the pulse generator 223 outputted by rotation of the aforementioned cam ring 212 and the above-mentioned

photograph reflectors 132a and 132b is carried out, respectively. In addition, the pulse number "40" which shows the pulse number "10" and S position which show wide end position to the storage element 135 which consists of an EEPROM is memorized.

[0069] Next, operation of a zoom lens which has the zoom encoder of this example constituted in this way is explained with the flow chart shown in drawing 15 - drawing 18 . First, if a camera is power switched [PWSW] off, CPU133 will detect this, will surely set a zoom lens to a collapsed state, and will stop camera operation. That is, when the collapsing routine shown in drawing 15 is described, as the collapsing field in a lens barrel was shown in aforementioned drawing 13 , the outputs PR1 and PR2 of the photograph reflectors 132a and 132b are the fields of PR 1= 1 and PR 2= 1. Therefore, when the power switch PWSW is turned off, CPU133 is input port P.R.1 and P.R.2, giving inversion instructions of a zoom motor to the motor drive circuit 134, and reversing a motor 220 in Step S1. It is made to reverse until it is set to 1 both, and this is checked (Step S2). And when this is set [both] to 1, motor halt instructions are given to the motor drive circuit 134, and the return of the rotation of the zoom motor 220 is stopped and (Step S3) carried out. A zoom lens is set now to a collapsing position.

[0070] Next, if the power switch PWSW is turned on, as shown in drawing 16 , a power-on routine will operate, and CPU133 will set a zoom taking lens to a delivery position with a focal distance of 35mm which is a wide edge W position from a collapsed state. That is, when the power switch PWSW is turned on, CPU133 is input port P.R.1 and P.R.2, giving normal rotation instructions (Step S11) of a zoom motor to the motor drive circuit 134, and rotating the zoom motor 220 normally first. Carrying out a monitor (Step S12) is continued. And if a taking lens moves to the position set to output P.R.1 =0 and P.R.2 =1 from the collapsed state position of output P.R.1 =1 and P.R.2 =1, synchronizing with this, CPU133 starts the rise count of pulse signal P.I from a pulse generator 223 (Step S13), will be Step S14 and will check this counted value. And rotation of a motor is continued until it reaches the pulse number "10" which shows the wide end position currently written in EEPROM135 (refer to drawing 14). In the place which reached the pulse number "10" of a schedule, it is made to stop (Step S15) and the return of the rotation of the zoom motor 220 is carried out. A zoom lens is set now as a wide edge W position with a focal distance of 35mm from a collapsed state.

[0071] Subsequently, if a photography person turns on the switch ZUSW for a zoom rise and performs zoom rise operation, ZU routine shown in drawing 17 will operate. If the above-mentioned switch ZUSW is turned on, CPU133 will confirm whether be in tele end position (T end position) first by the outputs PR1 and PR2 of the photograph reflectors 132a and 132b (Step S21). If it is in tele end position (T end position), it will shift to Step S28, halt processing will be performed by the zoom motor halt routine, and the return of the rise count of pulse signal P.I from a pulse generator 223 will be stopped and (Step S29) carried out.

[0072] If there is nothing to tele end position (T end position), it will shift to the following step S22, and the rise count of pulse signal P.I will be started. And the zoom motor 220 is normally rotated at Step S23. CPU133 is input port P.R.1 and P.R.2, continuing a rise count in the meantime. A monitor is carried out and the monitor (Step S25) of change (Step S24) of outputs PR1 and PR2 and the state of the switch ZUSW for a zoom rise is carried out. If a photography person will determine a desired zoom position if this switch ZUSW turns off namely, it will fly to Step S28, the zoom motor 220 will be suspended, and the return of the rise count of pulse signal P.I will be stopped and (Step S29) carried out. And if there is change (Step S24) of outputs PR1 and PR2 between them, S position or T end position will be checked in Step S26, if it is T end position, it will fly to Step S28, and the zoom motor 220 is suspended, and the return of the rise count of pulse signal P.I is stopped and (Step S29) carried out. Moreover, if it is S position, the counted value of P.I will be set to "40" in Step S27, and it will return to Step S24. It means that setting counted value to the above-mentioned value here had updated counted value, and it can make future counted value exact. Thus, the encoder at the time of zoom rise operation operates.

[0073] Next, if a photography person pushes the switch ZDSW for a zoom down and performs zoom down operation, ZD routine shown in drawing 18 will operate. If the above-mentioned switch ZDSW is turned on, CPU133 will detect it and the counted value of the present P.I will check first whether it is below the pulse number "10" of wide end position (Step S31). Consequently, with "10", it flies to Step S38. [below] If it is not a wide edge, since a lens is in the position of the zoom rise direction, a lens is moved in the zoom down direction. That is, the down count of P.I is made to start (Step S32), and the zoom motor 220 is reversed (Step S33). The monitor (Step S37) of change (Step S34) of outputs PR1 and PR2 and the state of the switch ZDSW for a zoom down is carried out continuing a down count in the meantime. And Switch ZDSW is turned off when a lens moves to the zoom position for which a photography person asks. If this switch ZDSW for a zoom down turns off, the zoom motor 220 will be normally rotated for backlash **** of a reduction gear (Step S38). P. The rise count (Step S39) of I is performed. Predetermined rise count (Step S40), For example, after 2 rise counts, the zoom motor 220 is suspended (Step S41), the count of pulse signal P.I is stopped (Step S42), and the return of the one count for backlash is subtracted and (Step S43) carried out from the counter of P.I. Moreover, in Step S37, if Switch ZDSW turns on, the loop which returns to Step S34 will be taken.

[0074] If there is change of outputs PR1 and PR2 in Step S34, next, the check of being S position will be performed at Step S35, on the other hand, if it is S position, the count of P.I will be set to "40+(part for backlash 1) =41" which shows S position in Step S36, and it returns to Step S31. Thus, it means that setting counted value to the above-mentioned value had updated counted value, and it makes future counted value exact. Thus, the encoder at the time of zoom down operation operates.

[0075]

[Effect of the Invention] Like, without causing enlargement of composition, and a cost rise according to this invention, since the mistake count which is the theoretic fault which was described above, and which a relative-value encoder has is also

automatically corrected on rise/down operation way of zoom, the relative-value non-contact type zoom encoder which reliability is remarkable and improved can be offered.

[Translation done.]

TECHNICAL FIELD

[Industrial Application] This invention relates to a zoom encoder and the zoom encoder used for the focal distance detection equipment of zoom photography optical system, such as a camera, in more detail.

[Translation done.]

PRIOR ART

[Description of the Prior Art] As everyone knows, the zoom encoder which detects the amount of rotation and the rotation direction of the cam ring to which the focal distance of photography optical system is changed is used for the focal distance detection equipment of the zoom photography optical system in a camera etc. by rotating around the optical axis of photography optical system.
[0003] In order to detect the rotation position of the cam ring which performs zooming by rotation, this zoom encoder forms a several bits code board, contacts a brush to this code board, and it is made to detect the rotation position of a cam ring. It has the following faults, although there is an advantage that the detection means of a rotation position with this code board can detect the rotation position of a cam ring as bit information from a code board. That is, the manufacturing cost of 1 code board is high.
2) Since bit information has been acquired by contact of a code board and a brush, the defective continuity by oxidization of a code board front face and a brush side occurs with time.
3) The defective continuity by the shortage of contact pressure, surface wear, etc. occurs with time.
It will say that a defect occurs that a defect occurs with time like especially the above 2 and 3 among such faults, after crossing to a user's hand, and it poses a very serious problem on the quality of a product.
[0004] Therefore, in order to solve the fault of the above 2 and 3 fundamentally, it is possible to change into a non-contact type absolute value encoder like the magnetic formula which used optical or MR element etc. which used a zoom encoder of a contact process which was mentioned above for the photograph reflector etc. However, this means has the space of an encoder, and a conversely large demerit on cost. At most 2 - the triplet of expanding and the more it being thought that it is possible practically, the more this demerit enlarges resolution of a zoom encoder are limitations.
[0005] Then, a means to ask for the rotation position of a cam ring is proposed by preparing the optical pulse generator which answers the rotation of a cam ring which performs zooming using the zoom encoder of the conventional contact process, and generates a pulse, and counting up or counting down the pulse output from this generator according to the hand of cut of the cam ring for zoom as indicated by JP,2-5130,U. According to this means, the zoom encoder of a high resolution can be obtained only with one photo interrupter.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] Like, without causing enlargement of composition, and a cost rise according to this invention, since the mistake count which is the theoretic fault which was described above, and which a relative-value encoder has is also automatically corrected on rise/down operation way of zoom, the relative-value non-contact type zoom encoder which reliability is remarkable and improved can be offered.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, the rotation position detection equipment using the zoom encoder indicated by above-mentioned JP,2-5130,U is the so-called relative-value encoder, and since it is not an absolute value encoder in a digital code like before, it has the following troubles theoretically.
(1) When a mistake count occurs by the incorrect pulse generated in the chatter ring of a pulse generator etc., it remains making a mistake, even if it changed the zoom state. Especially, in a non-contact type pulse generator, since an incorrect pulse occurs in the during starting of a zoom motor well, while making it carry out both-way movement of the zoom ring several times, a mistake count will be accumulated by it and it will have a serious bad influence for exposure and bit information as a result on it.
(2) Although the zoom value changed when the user pushed in or pulled the lens barrel, for example since the monitor of the output of a pulse generator was not necessarily carried out always, in the case of a camera etc., it cannot be detected, but after the zoom value has differed from the actual state, photography will be carried out to it, and it will have a serious bad influence for exposure and bit information as a result on it.
[0007] The purpose of this invention is to offer the non-contact type zoom encoder which is comparatively easy composition and is the theoretic fault which a relative-value encoder has and which can almost abolish practically the probability of occurrence of the trouble of the above (1) and (2), without causing enlargement of the composition by making non-contact the above-mentioned conventional absolute value encoder, and a cost rise.

[Translation done.]

MEANS

[Means for Solving the Problem] In the zoom encoder which detects the amount of rotation and the rotation direction of the cam ring to which the focal distance of photography optical system is changed by rotating around the optical axis of photography optical system as the encoder by this invention is shown in the conceptual diagram of drawing 1 O A non-contact type pulse generating means 2 to generate a pulse signal according to rotation of the above-mentioned cam ring which is the driving means 1 to which the focal distance of photography optical system is changed, With a count means 3 to respond in the rotation direction of the above-mentioned cam ring, and to add or subtract the above-mentioned pulse signal, it sets near a wide angle edge and near a tele edge a focal distance at least. A position detection means 4 to detect a position signal, and a counted value change means 5 to change the counted value of the above-mentioned count means 3 into a predetermined value according to change of the output of this position detection means 4, It is characterized by providing a zoom information detection means 6 to acquire zoom information by the output from the above-mentioned count means 3.

[Translation done.]

OPERATION

[Function] If the mid-position of a zoom moving range is arrived at, the counted value of a count means will be updated regardless of the number of pulse counts till then by the counted value corresponding to the exact focal distance.

[Translation done.]

EXAMPLE

[Example] Hereafter, the example of illustration explains this invention.
[0011] Drawing 2 shows the 1st example of this invention, and this zoom encoder 10 is applied to the zoom lens lens-barrel of a camera.
[0012] The zoom encoder 10 formed in the rotation ring 20 consists of three of the fields C exceeding the collapsing section A, the photography range section B, and tele end position, as shown in drawing 3 , among these silver or white with the high A section and C section, and the B section of a reflection factor serve as low black of a reflection factor. Furthermore, among drawing of drawing 2 , the above-mentioned rotation ring 20 rotates in the direction shown by sign A or I, and drives a zoom lens. And the output signal of the zoom photograph reflector 11 (ZPR) fixed to the position in the main part of a camera changes with rotation of this zoom encoder 10. Namely, when the above-mentioned photograph reflector 11 has met the position of alpha shown in drawing 3 , it is a collapsed state, and when this photograph reflector 11 has met the position of beta and the position of a wide state and gamma is met, it is in a tele state.
[0013] The zoom drive unit 30 The zoom motor 31 and the slowdown reduction-gear train 32, The slit 33 which is prepared on axial extension of the above-mentioned zoom motor 31, is interlocked with this zoom motor 31, and is rotated, The zoom photo interrupter 34 (ZPI) which is arranged near this slit 33 and generates an output signal according to rotation of this slit 33, It consists of output reduction gears 35 which gear to the last reduction gear of the above-mentioned slowdown reduction-gear train 32, gear with the drive reduction gear 21 prepared in the periphery of the above-mentioned rotation ring 20, and transmit the rotation force of the above-mentioned zoom motor 31 to the rotation ring 20.
[0014] In addition, the above-mentioned photograph reflector 11 and the outgoing end of a photo interrupter 34 are connected to CPU101 (refer to drawing 4) mentioned later, and CPU101 detects the present focal distance based on the output signal of this photograph reflector 11 and a photo interrupter 34.
[0015] Drawing 4 is the block schematic diagram of the zoom camera with which **** 1 example is applied.
[0016] In drawing, CPU101 is a microcomputer which controls operation of the above-mentioned whole zoom camera, and manages LCD [the sequence control of this zoom camera operation, auto-focusing / auto exposure (henceforth AF/AE) operation, A/D conversion,] / Light Emitting Diode control, and a switch input control.
[0017] the LCD panel 102 -- the piece of a film -- it is the liquid crystal display board which displays a number, a battery check result, etc., respectively
[0018] 1st step switch 1R which the switch control unit 103 operates when half-push [release **], and locks AF and AE, When turned on with 2nd step switch 2R for shutter release which operates when all push [release **], switch Z-UP for a zoom rise, and switch Z-DOWN for a zoom down The power-on switch POWER which the above CPU 101 displays on the above-mentioned LCD panel 102, and changes the whole zoom camera into the state which can be photoed It consists of a switch RW for compulsive rewinding [which performs rewinding under photography], and a back lid-open close switch BK which winds having shut the back lid rapidly by detecting.
[0019] Moreover, light emitting diode (IRED) and a sign 123 show a position sensor (PSD), and, as for a sign 124, IC (AFIC) for AF ranging in the inside of drawing and a sign 105 and a sign 122 show a photographic subject. The above AFIC105 floodlights infrared light for a photographic subject 124 based on the control signal from the above CPU 101, and ranges by detecting the reflected light by PSD123. And the obtained ranging data are transmitted to CPU101 through a serial data bus.
[0020] EEPROM106 is eliminable ROM electrically and has memorized various adjustment values, such as the number of film **, **** correction value stroboscope charge voltage information, and battery check information.
[0021] The stroboscope unit 108 will start charge, if a charge signal is given from the above CPU 101, charge voltage is sent to this CPU101, after A/D conversion is carried out, it is compared with the charge voltage information on EEPROM106, and it is confirmed whether to be the completion of charge.
[0022] The Light Emitting Diode display 109 is a display which tells a photography person about stroboscope luminescence warning, AF lock, etc.
[0023] IF-IC111 is constituted from an IC for an interface by the Light Emitting Diode drive circuit, the circuit which measures the strength of the light by SPD110, the motor drive circuit, the reference voltage circuit, etc.
[0024] Both the signs 112,113 are supplied to this IC112,113 for a drive, after the motorised signal which is IC for motorised and is sent out from the above CPU 101 is once decoded within above-mentioned IF-IC111. And which motor of the above-mentioned zoom motor 31, the AF motor 115, winding up, and the rewinding motor 116 is chosen by the signal of CPU101, and it drives.

[0025] Near the above-mentioned AF motor 115, the photo interrupter 126 which is interlocked with rotation of this motor 115 and generates an output signal is formed, and the above CPU 101 performs rotation control of this AF motor 115 based on the output of this photo interrupter 126.
[0026] Near the above-mentioned winding and the rewinding motor 116, similarly, the photo interrupter 127 which is interlocked with rotation of this motor 116 and generates an output signal is formed, and, as for the above CPU 101, rotation control of this motor 116 is performed based on the output of this photo interrupter 127.
[0027] The above-mentioned zoom motor 31 is controlled by CPU101 based on the output signal of a photo interrupter 34 and the photograph reflector 11, as mentioned above.
[0028] The automatic regulation material 120 is used as a checker at the time of performing AF, AE, battery check, stroboscope adjustment, etc. at works. Each of this data is sent to CPU101 through a serial data bus, and memorizes an adjustment value to the above EEPROM 106.
[0029] The DX code 150 of a film is directly read into CPU101, and is used as an operation value for deciding exposure value.
[0030] A sign 121 is a plunger for sector opening and closing, and a sign 125 is a detecting element which applies reset to CPU101 by the detecting element of a cell voltage at the time of a cell injection and returns of failed voltage.
[0031] Next, an operation of the zoom camera with which **** 1 example is applied is explained with reference to the flow chart shown in drawing 5 - drawing 8 .
[0032] Drawing 5 is the flow chart of the sub routine of the power on reset when supplying a power supply to this zoom camera.
[0033] In drawing, if a cell is inserted or the power switch POWER is switched, power on reset will start CPU101 and operation of a camera will be started. If the sub routine of this power on reset is called, after initial setting of RAM in each port and CPU101 is first performed at Step S101, the check judging of whether the automatic regulation machine 120 was connected to CPU101 will be performed at Step S102. As a result of this check, if the automatic regulation machine 120 is connected to CPU101, it will progress to Step S103 and communication with an external device will be performed. Moreover, if the above-mentioned automatic regulation machine 120 is not connected to CPU101, it progresses to Step S104 immediately, and a dc-battery check is performed. Here, when battery voltage is inadequate, while displaying those without a cell on the LCD panel 102, all camera operation is forbidden.
[0034] Then, in Step S105, after reading predetermined data from EEPROM106, the power switch POWER is checked at Step S106. Here, if the power switch POWER is off, it will progress to Step S120 and the display of the LCD panel 102 will be eliminated, and after the switches BK and RW which perform opening and closing and compulsive rewinding interrupting and granting a permission, it changes into a stop mode state. [of a back pig] If the power switch POWER is ON at the above-mentioned step S106, a zoom lens will be moved to the wide end position which can be photoed from a collapsing position at Step S113. And after progressing to Step S114 and displaying predetermined information on the LCD panel 102, stroboscope charge is performed at Step S115, and it considers as the state which can be photoed.
[0035] At Step S116, the display time to the LCD panel 102 is set to 90 seconds. And if a user operates a certain step, the timer for 90 seconds will be set again. After progressing to Step S118 and permitting interruption of open/close switch BK of a back swine, the rewinding switch RW, and other operation switches (henceforth KEY) to it if it had not passed to Step S119 when it progressed to Step S117, it judged whether 90 seconds passed and 90 seconds had passed, it changes into a halt mode state. When the switch with which interruption was permitted in the above-mentioned stop mode state and the halt mode state is pushed, the sub routine of the standby release shown in drawing 6 is performed.
[0036] Next, the sub routine of this standby release is explained with reference to the flow chart of drawing 6 .
[0037] First, interruption by the back pig switch BK is checked at Step S121. Here, if there is interruption by this back pig switch BK, it will be judged whether it progressed to Step S122 and the back pig has closed. After processing which progresses to Step S124 and opens a back pig at this step S122 if the back pig has not closed is performed, it returns to "1" of drawing 5 . Moreover, if the back pig has closed, after carrying out rapid-winding processing at Step S123, it returns to the above "1."
[0038] At Step S125, it rewinds and interruption by Switch RW is checked. Here, if there is interruption by this rewinding switch RW, it will progress to Step S127 and a film will be rewound.
[0039] Timer interruption is checked at Step S128. If there is timer interruption here, after progressing to Step S134 and performing display timer count processing, the strength of the light is measured at Step S135, and it returns to "2" of drawing 5 . When it is not timer interruption at the above-mentioned step S128, it progresses to Step S129 and film rewinding end or rapid-winding failure is checked. Here, if it is a film rewinding end or rapid-winding failure, it returns to "1" of drawing 5 so that a camera may not operate. Moreover, if it is not a film rewinding end or rapid-winding failure, it will progress to Step S130. If it is ON, the state of the power switch POWER is checked at this step S130, and if off, it progresses to the above "1", and it progresses to Step S131, and continues a main flow as it is.
[0040] The judgment of interruption by Above KEY is performed at the above-mentioned step S131. If after-mentioned each mode switch is pushed and interruption occurs, it will fly to "3" of drawing 7 , and if there is no interruption, it will progress to Step S132.
[0041] At the above-mentioned step S132, if a certain information confirms whether to be under [display] ****** on the LCD panel 102 and does not display [be / it] on it, it progresses to Step S133, interruption of KEY(s), such as each operation switches BK and RW, is permitted, and it will be in a stop mode state. If the LCD panel 102 expresses [be / it] as the

above-mentioned step S132, it returns to "2" of drawing 5 .
[0042] In addition, the switch in the switch control unit 103 indicated to be KEY in Step S117, Step S131, and Step S133 to drawing 4 is meant.
[0043] Next, the sub routine of processing of the above-mentioned KEY interruption is explained with reference to drawing 7 .
[0044] If there is KEY interruption at the above-mentioned step SS 131 (refer to drawing 6), it progresses to Step S141 of drawing 7 , and the LCD panel 102 (refer to drawing 4) is turned on. Then, it is confirmed whether progress to Step S143 and the 1st step of release switch 1R is pushed. If the 1st step of this release switch 1R is pushed, after performing release processing in Step S144, it will return to "1" of drawing 5 . If the 1st step of release switch 1R is off, it progresses to Step S146 at the above-mentioned step S143 and directions of a zoom rise or a zoom down are made, it will progress to Step S158. At this step S158, if the LCD panel 102 confirms whether to be under [display] ****** and displays, if it is not [be / it] under display, it will return to "2" of drawing 5 "4" of drawing 6 again.
[0045] In the above-mentioned step S146, when there are directions of a zoom rise or a zoom down, it progresses to Step S147 and zoom processing is made.
[0046] Next, the step in Step S113 of above-mentioned drawing 5 which moves a zoom lens to the wide end position which can be photoed from a collapsing position is explained in more detail with reference to the flow chart and drawing 10 of drawing 8 .
[0047] In Step S301, after rotating the zoom motor 31 (refer to drawing 4) normally, A/D conversion of the output signal of the above-mentioned photograph reflector 11 (refer to ZPR and drawing 4) is carried out at Step S302. Then, in Step S303, predetermined threshold #TH1 is subtracted from this A/D-conversion value.
[0048] Then, the comparison value in the above-mentioned step S303 is judged (CY), in Step S304, if a borrow does not come out, the above-mentioned A/D value are higher than above-mentioned threshold #TH1, i.e., the output signal of the photograph reflector 11 judges it as "H" level, and it returns to Step S302. If the above-mentioned A/D value become lower than threshold #TH1, it will judge that the output signal of the photograph reflector 11 was set to "L" level, and will progress to Step S305.
[0049] When the output value of the above-mentioned photo interrupter 34 (refer to ZPI and drawing 4) is checked (ZPIHRD) and there is a standup edge at Step S306 by this step S305 after resetting ZMPLS on RAM of the CPU101 interior which shows the current value of a zoom lens, Above ZMPLS is carried out +one.
[0050] Then, since it will be wide end position if it returns to the above-mentioned step S306 and there is no borrow, since it still will not be wide end position if value #WIDE which shows wide end position is subtracted from the current value ZMPLS of a zoom lens, a comparison value is judged in Step S308 (CY) and there is a borrow at Step S307, it progresses to Step S309.
[0051] At this step S309, after applying brakes to the zoom motor 31 (ZMOTBK) and carrying out fixed time standby in Step S310, the zoom motor 31 is stopped in (TI) and Step S311, and it returns to a main routine (Step S312).
[0052] Next, the zoom processing in the above-mentioned step S147 is explained with reference to the flow chart of drawing 9 .
[0053] At a step SS 501, port initialization of CPU101 (refer to drawing 4) required for a zoom motor drive and starting of IFIC111 are performed. Then, in Step S502, if the flag ZUDF which shows the driving direction of the zoom motor 31 (refer to drawing 4) is seen and it becomes this flag ZUDF=1, it will progress to Step S504 so that the zoom motor 31 may be rotated normally. In the above-mentioned step S502, at the time of flag ZUDF=0, it progresses to a step SS 503 so that this zoom motor 31 may be reversed.
[0054] Then, in Step S511, it confirms whether it was turned on any of the zoom switch ZSW, i.e., aforementioned switch Z-UP for a zoom rise and switch Z-DOWN for a zoom down, they are (CK), and if this zoom switch ZSW is all off, it will progress to Step S516.
[0055] When it is turned on at the above-mentioned step S511 any of switch Z-UP for a zoom rise and switch Z-DOWN for a zoom down they are, it progresses to Step S512.
[0056] At this step S512, it judges whether the zoom position turned into wide end position or tele end position by the above ZMPLS which shows the current value of a zoom lens, and the above-mentioned zoom motor 31 is progressed to the halt way step S516 in the place which became one of the wide end-position and tele end position. Moreover, at the above-mentioned step S512, when the zoom lens position has not reached wide end position or tele end position, next, it progresses to Step S513.
[0057] At this step S513, during the usual zoom operation, although the output signal of the above-mentioned photograph reflector 11 (ZPR) is "L" level, when set to "H" level during a zoom drive, it judges it as an incorrect count and resets Above ZMPLS. Moreover, when the output signal of this photograph reflector 11 (ZPR) is set to "H" level during a zoom down, the zoom motor 31 is rotated normally, and if zoom processing mentioned above is performed, it can reset. Moreover, the pulse for value #TELE which shows tele end position in the place where the output signal of this photograph reflector 11 (ZPR) became "H" level exceeding threshold #TH2 (refer to drawing 11) is counted at the time of a zoom rise, and it resets Above ZMPLS to the pulse number equivalent to tele end position.
[0058] Then, the timer for detection of a photo interrupter 34 (ZPI) is started at Step S514, at Step S515, the pulse standup of this photo interrupter 34 is checked, and Above ZMPLS is counted up or counted down. Here, within fixed time, if there is no standup of this photo interrupter 34, it will be judged as failure of the zoom motor 31 or the zoom encoder 10, and will go to

exception processing (DAMAG) of Step S521.
[0059] If the above-mentioned step S516 judges the above-mentioned flag ZUDF and it becomes ZUDF=0, it will progress to Step S517.
[0060] This step S517 performs backlash **** of a gear by on the other hand driving a mechanism to **. When the zoom motor 31 is normally rotated as an amount of drives and standup 1 pulse of a photo interrupter 34 arises, this motor 31 is suspended.
[0061] Then, fixed time brakes are applied to the above-mentioned zoom motor 31 at Step S518 (ZMMOTB), and after stopping this zoom motor 31 at Step S519, it returns to a main routine (Step S520).
[0062] Drawing 12 shows the 2nd example of this invention, and this zoom encoder 210 is applied to the zoom lens lens-barrel of a camera. The inclination-cam-die slotted hole 213,214 for moving the built-in zoom lens group 211 which consists of pre-group lenses, such as barricade ETA, and back group lenses, such as a compensator, in the direction of an optical axis is drilled by the cam ring 212 which consists of a cam cylinder for a zoom lens drive. The guide pin 216,217 which stood erect in one, respectively is fitted in the pre-group lens maintenance frame and back group lens maintenance frame which are not illustrated at this cam slotted hole 213,214.
[0063] The sector reduction gear 219 for a ring drive is formed for the main part 215 of a camera of the above-mentioned cam ring 212 in the peripheral face of the base approach of ** at one at the hoop direction, and the reduction gear 218 for a drive has geared to this sector reduction gear 219. The turning effort of the output reduction gear 221 of a motor 220 is transmitted to this reduction gear 218 for a drive through a speed reducing gear train 222. Therefore, if the above-mentioned motor 220 is rotated normally or inversion driven, the turning effort will be transmitted to the reduction gear 218 for a drive through a speed reducing gear train 222. this -- a cam ring 212 -- the surroundings of an optical axis -- the right direction or an opposite direction -- rotating -- the above-mentioned cam groove -- by the hole 213,214 and the guide pin 216,217 A pre-group lens maintenance frame and a back group lens maintenance frame move in the direction of an optical axis so that the interval of a pre-group lens and a back group lens may be changed, and zooming of a zoom taking lens is made by this.
[0064] Moreover, to the above-mentioned reduction gear 218 for a drive, the reduction gear 225 for carrying out the rotation drive of the rotor plate 224 for pulse generating of a pulse generator 223 has geared. The above-mentioned pulse generator 223 consists of photo interrupters 226 which consist of the optical irradiation section by which it was countered and arranged in the circumferencial direction on both sides of a part of above-mentioned rotor plate 224 in which the translucent part formed so that a large number might begin to be prolonged in the ****** radiation direction at equal intervals, and the shading section were formed by turns, and this rotor plate 224, and a light sensing portion. Rotation of the reduction gear 218 for a drive which carries out the rotation drive of the above-mentioned cam ring 212 is interlocked with, a rotor plate 224 rotates, and this pulse generator 223 outputs the pulse signals P and I which answer rotation of a cam ring 212 with a photo interrupter 226.
[0065] And the pattern 130 for reading for absolute value encoders is formed in a part of peripheral face of the above-mentioned cam ring 212. This pattern 130 for reading is formed by the pattern of the shape of toothing of the heights of the high reflection factor section, and the crevice of the non-reflecting section, in the **** 2 example, makes the peripheral face of the cam ring itself heights, and forms it by the hole which drilled the crevice in the cam ring. Namely, as the flat-surface configuration is expanded and shown in drawing 13 , this pattern 130 for reading The crevice which the whole configuration becomes a hoop direction from an oblong rectangle, and consists of hole 130a drilled in the left section in the shape of L character, and hole 130b drilled in the method top half section of the right in the shape of an angle hole, It is prepared in the center section and formed by the heights which consist of high reflection factor section 131b formed in the position which forms successively to high reflection factor section 131a and said high reflection factor section 131a which countered the above-mentioned hole 130a and were formed in inverse L-shaped, and counters the above-mentioned hole 130b.
[0066] Thus, it is the position which counters the formed pattern 130 for reading, i.e., the outside of a cam ring 212, and as shown in the position which counters the above-mentioned pattern 130 for reading at drawing 12 , the photograph reflectors 132a and 132b are being fixed to the immobility member which is located in a line in the direction of an optical axis, and is not illustrated. And these photograph reflectors (P. R) 132a and 132b generate the output signals PR1 and PR2 of an absolute value encoder.
[0067] That is, as these photograph reflectors 132a and 132b are shown in drawing 13 , the output signals PR1 and PR2 change [rotation / of a cam ring 212] with ->(1.1) (0.1) ->(0.0) -> (1.0).
Here, standard position (S position) O (0.0) and the changing point of (1.0) are set [the changing point of (1.1) and (0.1) / between collapsing position O (0.1) and (0.0)] up for wide edge (wide angle edge) position O (0.1) and the changing point of (0.0) as tele edge (looking far) position O, respectively. In addition, the zoom lens whose zoom scale factor is 35mm - 80mm in this example shall be used, and it becomes 35mm at a wide edge (W end position), and becomes the focal distance of 80mm at a tele edge (T end position).
[0068] Drawing 14 shows the composition of the important section of the electrical circuit of the camera with which the above-mentioned zoom encoder was applied. Each actuating signal of the power switch PWSW, the switch ZUSW for a zoom rise, and the switch ZDSW for a zoom down inputs, respectively, and in CPU133 which carries out sequence control of zooming operation and photography operation of a camera, CPU133 controls the motor drive circuit 134 by these signals, and controls rotation of the aforementioned drive motor 220 by them to it. And the monitor of the output signals PR1 and PR2 of pulse signal P.I of the pulse generator 223 outputted by rotation of the aforementioned cam ring 212 and the above-mentioned

photograph reflectors 132a and 132b is carried out, respectively. In addition, the pulse number "40" which shows the pulse number "10" and S position which show wide end position to the storage element 135 which consists of an EEPROM is memorized.

[0069] Next, operation of a zoom lens which has the zoom encoder of this example constituted in this way is explained with the flow chart shown in drawing 15 - drawing 18 . First, if a camera is power switched [PWSW] off, CPU133 will detect this, will surely set a zoom lens to a collapsed state, and will stop camera operation. That is, when the collapsing routine shown in drawing 15 is described, as the collapsing field in a lens barrel was shown in aforementioned drawing 13 , the outputs PR1 and PR2 of the photograph reflectors 132a and 132b are the fields of PR 1= 1 and PR 2= 1. Therefore, when the power switch PWSW is turned off, CPU133 is input port P.R.1 and P.R.2, giving inversion instructions of a zoom motor to the motor drive circuit 134, and reversing a motor 220 in Step S1. It is made to reverse until it is set to 1 both, and this is checked (Step S2). And when this is set [both] to 1, motor halt instructions are given to the motor drive circuit 134, and the return of the rotation of the zoom motor 220 is stopped and (Step S3) carried out. A zoom lens is set now to a collapsing position.

[0070] Next, if the power switch PWSW is turned on, as shown in drawing 16 , a power-on routine will operate, and CPU133 will set a zoom taking lens to a delivery position with a focal distance of 35mm which is a wide edge W position from a collapsed state. That is, when the power switch PWSW is turned on, CPU133 is input port P.R.1 and P.R.2, giving normal rotation instructions (Step S11) of a zoom motor to the motor drive circuit 134, and rotating the zoom motor 220 normally first. Carrying out a monitor (Step S12) is continued. And if a taking lens moves to the position set to output P.R.1 =0 and P.R.2 =1 from the collapsed state position of output P.R.1 =1 and P.R.2 =1, synchronizing with this, CPU133 starts the rise count of pulse signal P.I from a pulse generator 223 (Step S13), will be Step S14 and will check this counted value. And rotation of a motor is continued until it reaches the pulse number "10" which shows the wide end position currently written in EEPROM135 (refer to drawing 14). In the place which reached the pulse number "10" of a schedule, it is made to stop (Step S15) and the return of the rotation of the zoom motor 220 is carried out. A zoom lens is set now as a wide edge W position with a focal distance of 35mm from a collapsed state.

[0071] Subsequently, if a photography person turns on the switch ZUSW for a zoom rise and performs zoom rise operation, ZU routine shown in drawing 17 will operate. If the above-mentioned switch ZUSW is turned on, CPU133 will confirm whether be in tele end position (T end position) first by the outputs PR1 and PR2 of the photograph reflectors 132a and 132b (Step S21). If it is in tele end position (T end position), it will shift to Step S28, halt processing will be performed by the zoom motor halt routine, and the return of the rise count of pulse signal P.I from a pulse generator 223 will be stopped and (Step S29) carried out.

[0072] If there is nothing to tele end position (T end position), it will shift to the following step S22, and the rise count of pulse signal P.I will be started. And the zoom motor 220 is normally rotated at Step S23. CPU133 is input port P.R.1 and P.R.2, continuing a rise count in the meantime. A monitor is carried out and the monitor (Step S25) of change (Step S24) of outputs PR1 and PR2 and the state of the switch ZUSW for a zoom rise is carried out. If a photography person will determine a desired zoom position if this switch ZUSW turns off namely, it will fly to Step S28, the zoom motor 220 will be suspended, and the return of the rise count of pulse signal P.I will be stopped and (Step S29) carried out. And if there is change (Step S24) of outputs PR1 and PR2 between them, S position or T end position will be checked in Step S26, if it is T end position, it will fly to Step S28, and the zoom motor 220 is suspended, and the return of the rise count of pulse signal P.I is stopped and (Step S29) carried out. Moreover, if it is S position, the counted value of P.I will be set to "40" in Step S27, and it will return to Step S24. It means that setting counted value to the above-mentioned value here had updated counted value, and it can make future counted value exact. Thus, the encoder at the time of zoom rise operation operates.

[0073] Next, if a photography person pushes the switch ZDSW for a zoom down and performs zoom down operation, ZD routine shown in drawing 18 will operate. If the above-mentioned switch ZDSW is turned on, CPU133 will detect it and the counted value of the present P.I will check first whether it is below the pulse number "10" of wide end position (Step S31). Consequently, with "10", it flies to Step S38. [below] If it is not a wide edge, since a lens is in the position of the zoom rise direction, a lens is moved in the zoom down direction. That is, the down count of P.I is made to start (Step S32), and the zoom motor 220 is reversed (Step S33). The monitor (Step S37) of change (Step S34) of outputs PR1 and PR2 and the state of the switch ZDSW for a zoom down is carried out continuing a down count in the meantime. And Switch ZDSW is turned off when a lens moves to the zoom position for which a photography person asks. If this switch ZDSW for a zoom down turns off, the zoom motor 220 will be normally rotated for backlash **** of a reduction gear (Step S38). P. The rise count (Step S39) of I is performed. Predetermined rise count (Step S40), For example, after 2 rise counts, the zoom motor 220 is suspended (Step S41), the count of pulse signal P.I is stopped (Step S42), and the return of the one count for backlash is subtracted and (Step S43) carried out from the counter of P.I. Moreover, in Step S37, if Switch ZDSW turns on, the loop which returns to Step S34 will be taken.

[0074] If there is change of outputs PR1 and PR2 in Step S34, next, the check of being S position will be performed at Step S35, on the other hand, if it is S position, the count of P.I will be set to "40+(part for backlash 1) =41" which shows S position in Step S36, and it returns to Step S31. Thus, it means that setting counted value to the above-mentioned value had updated counted value, and it makes future counted value exact. Thus, the encoder at the time of zoom down operation operates.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The conceptual diagram of the zoom encoder of this invention.
[Drawing 2] The perspective diagram of the zoom encoder in which the 1st example of this invention is shown.
[Drawing 3] The diagram showing the relation of the pattern for reading of a photograph reflector and photograph reflector output in the 1st example of the above.
[Drawing 4] The block block diagram of the electrical circuit of the important section of the zoom encoder of the 1st example of the above.
[Drawing 5] The flow chart which shows the sub routine at the time of power on reset when switching on a power supply to the zoom camera with which the 1st example of the above is applied.
[Drawing 6] The flow chart which shows the sub routine at the time of standby release of the zoom camera with which the 1st example of the above is applied.
[Drawing 7] The sub routine **** flow chart of the switch operation **** interruption processing in the zoom camera with which the 1st example of the above is applied.
[Drawing 8] The flow chart which shows operation at the time of a zoom lens being moved to the wide end position which can be photoed from a collapsing position in the zoom camera with which the 1st example of the above is applied.
[Drawing 9] The flow chart which shows the zoom processing in the zoom camera with which the 1st example of the above is applied.
[Drawing 10] The timing diagram which showed the relation with the output signal of the zoom motor and zoom photograph reflector at the time of a zoom lens being moved to the wide end position which can be photoed from a collapsing position, and a zoom photo interrupter in the zoom camera with which the 1st example of the above is applied.
[Drawing 11] The timing diagram which showed the relation with the output signal of the zoom motor and zoom photograph reflector at the time of a zoom lens being moved to the tele end position which can be photoed from a collapsing position, and a zoom photo interrupter in the zoom camera with which the 1st example of the above is applied.
[Drawing 12] The perspective diagram of the zoom encoder in which the 2nd example of this invention is shown.
[Drawing 13] The diagram showing the relation of the pattern for reading of a photograph reflector and photograph reflector output in the 2nd example of the above.
[Drawing 14] The block block diagram of the electrical circuit of the important section of the zoom encoder of the 2nd example of the above.
[Drawing 15] The flow chart of the program of the collapsing routine of the zoom lens in the zoom camera with which the 2nd example of the above is applied.
[Drawing 16] The flow chart of the program of the power-on routine when power switching off the zoom camera with which the 2nd example of the above is applied.
[Drawing 17] The flow chart of the program of ZU routine when zoom rise switching off the zoom camera with which the 2nd example of the above is applied.
[Drawing 18] The flow chart of the program of ZD routine when zoom down switching off the zoom camera with which the 2nd example of the above is applied.
[Description of Notations]
1 -- Zoom driving means
2 -- Non-contact type pulse generating means
3 -- Pulse count means
4 -- Zoom predetermined position detection means
5 -- Renewal means of counted value
10 -- Zoom encoder
11 -- Zoom photograph reflector
20 -- Rotation ring
30 -- Zoom motor drive unit
31 -- Zoom motor
34 -- Zoom photo interrupter

[Translation done.]

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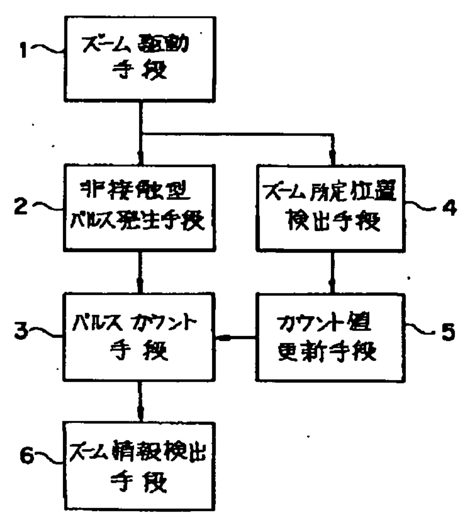
(54)【発明の名称】　ズームエンコーダ

(57)【要約】

【目的】本発明は、従来の絶対値エンコーダを非接触化することによる構成の大型化、並びにコストアップを招くことなく、比較的簡単な構成で、かつ相対値エンコーダのもつ原理的な欠点を実用上、殆ど無くすことのできる非接触型のズームエンコーダを提供するにある。

【構成】撮影光学系の光軸の周りに回動することにより撮影光学系の焦点距離を変化させるカムリングの、回動量および回動方向を検出するズームエンコーダにおいて、◎撮影光学系の焦点距離を変化させる駆動手段1である上記カムリングの回動に応じてパルス信号を発生する非接触型のパルス発生手段2と、上記カムリングの回動方向に応じて上記パルス信号を加算もしくは減算するカウント手段3と、少なくとも焦点距離の広角端付近と望遠端付近において、所定の位置信号を検出する位置検出手段4と、この位置検出手段4の出力の変化に応じて上記カウント手段3のカウント値を所定の値に変更するカウント値変更手段5と、上記カウント手段3からの出力によりズーム情報を得るズーム情報検出手段6とを具備したことを特徴とする。



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【特許請求の範囲】

【請求項１】撮影光学系の光軸の周りに回動することにより撮影光学系の焦点距離を変化させるカムリングの、回動量および回動方向を検出するズームエンコーダにおいて、

上記カムリングの回動に応じてパルス信号を発生する非接触型のパルス発生手段と、

上記カムリングの回動方向に応じて上記パルス信号を加算もしくは減算するカウント手段と、

少なくとも焦点距離の広角端付近と望遠端付近において、所定の位置信号を検出する位置検出手段と、

この位置検出手段の出力の変化に応じて上記カウント手段のカウント値を所定の値に変更するカウント値変更手段と、

を具備したことを特徴とするズームエンコーダ。

【請求項２】上記位置検出手段は、さらに上記焦点距離の広角端と望遠端との中間領域において、所定の中間位置を検出することを特徴とする、請求項１記載のズームエンコーダ。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】この発明は、ズームエンコーダ、更に詳しくは、カメラ等のズーム撮影光学系の焦点距離検出装置に用いられるズームエンコーダに関するものである。

【０００２】

【従来の技術】周知のように、カメラ等におけるズーム撮影光学系の焦点距離検出装置には、撮影光学系の光軸の周りに回動することにより、撮影光学系の焦点距離を変化させるカムリングの、回動量および回動方向を検出するズームエンコーダが用いられている。

【０００３】このズームエンコーダは回転によってズーミングを行うカムリングの回転位置を検出するために、数ビットのコード板を設け、このコード板にブラシを接触させてカムリングの回転位置を検出するようにしている。このコード板による回転位置の検出手段は、カムリングの回転位置をコード板からのビット情報として検出できるという利点はあるが、次のような欠点を有している。すなわち、

１）コード板の製造コストが高い。

２）コード板とブラシの接触によってビット情報を得ているために、コード板表面，ブラシ面の酸化による導通不良が経時的に発生する。

３）接触圧不足や表面の摩耗等による導通不良が経時的に発生する。

このような欠点のうち、特に上記２），３）のように経時的に不良が発生するということは、ユーザーの手に渡った後に不良が発生するということになり、製品の品質上、非常に重大な問題となる。

【０００４】したがって、上記２），３）の欠点を根本的に解決するには、上述したような接触式のズームエンコーダをフォトリフレクタ等を使用した光学式またはＭＲ素子等を使用した磁気式のような非接触型の絶対値エンコーダに変換することが考えられる。しかしながら、この手段は逆にエンコーダのスペースおよびコスト上のデメリットが大きい。このデメリットは、ズームエンコーダの分解能を大きくすればする程、拡大するものであり、実用上可能と考えられるのは、せいぜい２～３ビットが限界である。

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【０００５】そこで、実開平２－５１３０号公報に開示されているように、従来の接触式のズームエンコーダを用い、ズーミングを行うカムリングの回転に応答してパルスを発生する、光学式のパルス発生器を設け、この発生器からのパルス出力をズーム用カムリングの回転方向に応じてカウントアップもしくはカウントダウンすることにより、カムリングの回転位置を求める手段が提案されている。この手段によれば、１個のフォトインタラプタのみで高分解能のズームエンコーダを得ることができる。

【０００６】

【発明が解決しようとする課題】ところが、上記実開平２－５１３０号公報に開示されたズームエンコーダを用いる回転位置検出装置は、いわゆる相対値エンコーダであって、従来のようなデジタルコードによる絶対値エンコーダでないために、原理的に次のような問題点がある。

（１）パルス発生器のチャッタリング等で発生する誤パルスによりミスカウントが発生した場合、ズーム状態を変えても間違ったままになる。特に、非接触型のパルス発生器ではズームモータの起動時に、よく誤パルスが発生するため、ズーム環を何回か往復移動させているうちに、ミスカウントが累積され、結果として露出およびビット情報に重大な悪影響を及ぼすことになる。

（２）カメラなどの場合には、パルス発生器の出力を始終モニタしているわけではないので、例えばユーザがレンズ鏡筒を押し込んだり、引っ張ったりすると、ズーム値が変化したにも係わらず、それを検知することができず、ズーム値が実際の状態と異なった状態で撮影が行われることになり、結果として露出およびビット情報に重大な悪影響を及ぼすことになる。

【０００７】本発明の目的は、上記従来の絶対値エンコーダを非接触化することによる構成の大型化、並びにコストアップを招くことなく、比較的簡単な構成で、かつ相対値エンコーダのもつ原理的な欠点である、前記（１）（２）の問題点の発生確率を実用上、殆ど無くすことのできる非接触型のズームエンコーダを提供するにある。

【０００８】

【課題を解決するための手段】本発明によるエンコーダは、図１の概念図に示すように、撮影光学系の光軸の周

りに回動することにより撮影光学系の焦点距離を変化させるカムリングの、回動量および回動方向を検出するズームエンコーダにおいて、◎撮影光学系の焦点距離を変化させる駆動手段１である上記カムリングの回動に応じてパルス信号を発生する非接触型のパルス発生手段２と、上記カムリングの回動方向に応じて上記パルス信号を加算もしくは減算するカウント手段３と、少なくとも焦点距離の広角端付近と望遠端付近において、所定の位置信号を検出する位置検出手段４と、この位置検出手段４の出力の変化に応じて上記カウント手段３のカウント値を所定の値に変更するカウント値変更手段５と、上記カウント手段３からの出力によりズーム情報を得るズーム情報検出手段６とを具備したことを特徴とする。

【０００９】

【作用】ズーム移動範囲の中間位置に達したら、それまでのパルスカウント数に関係なく、カウント手段のカウント値は、正確な焦点距離に対応したカウント値に更新される。

【００１０】

【実施例】以下、図示の実施例によって本発明を説明する。

【００１１】図２は、本発明の第１実施例を示したものであって、このズームエンコーダ１０は、カメラのズームレンズ鏡筒に適用されている。

【００１２】回転環２０に設けられたズームエンコーダ１０は図３に示すように沈胴部Ａ，撮影範囲部Ｂ，テレ端位置を越える領域Ｃの３つから成っていて、このうちＡ部とＣ部は反射率の高い銀色もしくは白色、また、Ｂ部は反射率の低い黒色となっている。さらに、上記回転環２０は、図２の図中、符号アまたはイで示す方向に回動してズームレンズを駆動するようになっている。そして、このズームエンコーダ１０の回動により、カメラ本体内の所定の位置に固定されたズームフォトリフレクタ１１（ＺＰＲ）の出力信号が変化するようになっている。すなわち、図３に示すαの位置に上記フォトリフレクタ１１が対面しているときは沈胴状態であり、βの位置に該フォトリフレクタ１１が対面しているときはワイド状態、γの位置に対面しているときはテレ状態である。

【００１３】ズーム駆動ユニット３０は、ズームモータ３１と、減速ギアー列３２と、上記ズームモータ３１の軸延長上に設けられ、該ズームモータ３１と連動して回動するスリット３３と、このスリット３３の近傍に配置され、該スリット３３の回動に応じて出力信号を生成するズームフォトインタラプタ３４（ＺＰＩ）と、上記減速ギアー列３２の最終ギアーに噛合し、上記回転環２０の外周に設けられた駆動ギアー２１と噛合して上記ズームモータ３１の回動力を回転環２０に伝達する出力ギアー３５とで構成されている。

【００１４】なお、上記フォトリフレクタ１１およびフォトインタラプタ３４の出力端は後述するＣＰＵ１０１（図４参照）に接続されていて、該フォトリフレクタ１１およびフォトインタラプタ３４の出力信号に基づいてＣＰＵ１０１が現在の焦点距離を検出するようになっている。

【００１５】図４は本第１実施例が適用されるズームカメラのブロック系統図である。

【００１６】図において、ＣＰＵ１０１は上記ズームカメラ全体の動作を制御するマイクロコンピュータであって、該ズームカメラ動作のシーケンス制御、オートフォーカス／オートイクスポージャー（以下、ＡＦ／ＡＥという）演算、Ａ／Ｄ変換、ＬＣＤ／ＬＥＤ制御およびスイッチ入力制御を司どる。

【００１７】ＬＣＤパネル１０２はフィルムの駒数、バッテリチェック結果等をそれぞれ表示する液晶表示板である。

【００１８】スイッチ操作部１０３は、レリーズ釦を半押ししたときに作動し、ＡＦ、ＡＥをロックする１段目スイッチ１Ｒと、レリーズ釦を全押ししたときに作動する、シャッターレリーズ用の２段目スイッチ２Ｒと、ズームアップ用のスイッチＺ－ＵＰと、ズームダウン用スイッチＺ－ＤＯＷＮと、オンされたときに、上記ＣＰＵ１０１は、上記ＬＣＤパネル１０２に表示を行ってズームカメラ全体を撮影可能状態にするパワーオンスイッチＰＯＷＥＲと、撮影中の巻戻しを行う強制巻戻し用のスイッチＲＷと、裏蓋を閉めたことを検知して空送りを行う裏蓋開閉スイッチＢＫとで構成されている。

【００１９】また、図中、符号１０５はＡＦ測距用のＩＣ（ＡＦＩＣ）、符号１２２は発光ダイオード（ＩＲＥＤ）、符号１２３は位置センサー（ＰＳＤ）、符号１２４は被写体を示す。上記ＡＦＩＣ１０５は、上記ＣＰＵ１０１からの制御信号に基づき被写体１２４に赤外光を投光し、その反射光をＰＳＤ１２３で検出し測距を行うようになっている。そして、得られた測距データは、シリアルデータバスを通じてＣＰＵ１０１に転送されるようになっている。

【００２０】ＥＥＰＲＯＭ１０６は、電気的に消去可能なＲＯＭであり、フィルム駆数、電出補正値ストロボ充電電圧情報、バッテリチェック情報等の各種調整値を記憶している。

【００２１】ストロボユニット１０８は、上記ＣＰＵ１０１からチャージ信号が与えられると充電を開始し、充電電圧は該ＣＰＵ１０１へ送られ、Ａ／Ｄ変換された後、ＥＥＰＲＯＭ１０６の充電電圧情報と比較され、充電完了か否かがチェックされるようになっている。

【００２２】ＬＥＤ表示部１０９は、ストロボ発光警告、ＡＦロック等を撮影者に知らせる表示部である。

【００２３】ＩＦ－ＩＣ１１１はインターフェース用ＩＣでＬＥＤドライブ回路、ＳＰＤ１１０によって測光を行なう回路、モータドライブ回路、基準電圧回路等によ

り構成されている。

【0024】符号112，113は、ともにモータ駆動用ICであり、上記CPU101から送出されるモータ駆動信号が上記IF－IC111内で1度デコードされた後、この駆動用IC112，113に供給されるようになっている。そして、CPU101の信号により上記ズームモータ31，AFモータ115，巻上，巻戻しモータ116の何れかのモータが選択されて駆動されるようになっている。

【0025】上記AFモータ115の近傍には、該モータ115の回動に連動して出力信号を生成するフォトインタラプタ126が設けられていて、上記CPU101は、該フォトインタラプタ126の出力に基づいて該AFモータ115の回動制御を行うようになっている。

【0026】上記巻上げ、巻戻しモータ116の近傍にも同様に、該モータ116の回動に連動して出力信号を生成するフォトインタラプタ127が設けられていて、上記CPU101は、該フォトインタラプタ127の出力に基づいて該モータ116の回動制御を行うようになっている。

【0027】上記ズームモータ31は、上述したようにフォトインタラプタ34およびフォトリフレクタ11の出力信号に基づいてCPU101により制御されるようになっている。

【0028】自動調整材120は、AF，AE、バッテリチェック、ストロボ調整等を工場で行なう際のチェッカとして使用される。この各データはシリアルデータバスを通じてCPU101に送られ、調整値を上記EEPROM106に記憶するようになっている。

【0029】フィルムのDXコード150は、CPU101に直接読み込まれ、露出値を決めるための演算値として使われるようになっている。

【0030】符号121はセクタ開閉用のプランジャであり、符号125は電池電圧の検出部で電池投入時や、電圧復帰時にCPU101にリセットをかける検出部である。

【0031】次に、本第1実施例が適用されるズームカメラの作用について、図5～図8に示すフローチャートを参照して説明する。

【0032】図5は、該ズームカメラに電源を投入したときのパワーオンリセットのサブルーチンのフローチャートである。

【0033】図において、電池を挿入し、またはパワースイッチPOWERを切り換えると、CPU101にパワーオンリセットがかかりカメラの動作が開始される。このパワーオンリセットのサブルーチンが呼び出されると、先ずステップS101で各ポートおよびCPU101内のRAMの初期設定が行われた後、ステップS102で、自動調整機120がCPU101に接続されたか否かのチェック判定を行う。このチェックの結果、自動調整機120がCPU101に接続されていればステップS103に進んで、外部装置との通信を行う。また、上記自動調整機120がCPU101に接続されていなければ、直ちにステップS104に進んでバッテリーチェックを行う。ここで、バッテリ電圧が不充分の場合は、LCDパネル102に電池なしを表示すると共に全てのカメラ動作を禁止する。

【0034】この後、ステップS105において、EEPROM106から所定のデータを読み込んだ後、ステップS106ではパワースイッチPOWERをチェックする。ここで、パワースイッチPOWERがオフならばステップS120に進みLCDパネル102の表示を消去し、裏ブタの開閉や強制巻戻しを行うスイッチBKおよびRWの割り込み許可した後、ストップモード状態にする。上記ステップS106でパワースイッチPOWERがオンならばステップS113でズームレンズを沈胴位置から撮影可能なワイド端位置へ移動させる。そして、ステップS114に進んでLCDパネル102に所定の情報を表示させた後、ステップS115でストロボチャージを行い撮影可能状態とする。

【0035】ステップS116では、LCDパネル102への表示時間を、たとえば、90秒にセットする。そしてユーザが何等かのステップを操作すれば再度90秒のタイマがセットされることになる。ステップS117に進んで、90秒経過したか否かを判断し、90秒経過していればステップS119へ、経過していなければステップS118に進んで、裏ブタの開閉スイッチBK，巻戻しスイッチRWおよび他の操作スイッチ（以下、KEYという）の割り込みの許可をした上でホルトモード状態にする。上記ストップモード状態，ホルトモード状態で割り込みの許可されたスイッチが押されたときは、図6に示す、スタンバイ解除のサブルーチンが実行される。

【0036】次に、このスタンバイ解除のサブルーチンを図6のフローチャートを参照して説明する。

【0037】まず、ステップS121で裏ブタスイッチBKによる割込みがチェックされる。ここで、この裏ブタスイッチBKによる割込みがあれば、ステップS122に進んで裏ブタが閉じているか否かが判断される。このステップS122で、裏ブタが閉じていなければステップS124へ進んで裏ブタを開ける処理が行われた後、図5の“1”へ戻る。また、裏ブタが閉じているならばステップS123で空送り処理をした後、上記“1”へ戻る。

【0038】ステップS125では巻戻しスイッチRWによる割込みがチェックされる。ここで、この巻戻しスイッチRWによる割込みがあればステップS127に進んでフィルムの巻戻しを行う。

【0039】ステップS128ではタイマ割込みがチェックされる。ここでタイマ割込みがあればステップS1

３４に進んで表示タイマカウント処理を行った後、ステップＳ１３５で測光を行い図5の“2”へ戻る。上記ステップＳ１２８でタイマ割込みでない場合は、ステップＳ１２９に進んでフィルム巻戻し終了か空送り失敗かのチェックを行う。ここで、フィルム巻戻し終了か空送り失敗ならカメラが動作しないように図5の“1”へ戻る。また、フィルム巻戻し終了か空送り失敗でなければ、ステップＳ１３０へ進む。このステップＳ１３０ではパワースイッチＰＯＷＥＲの状態をチェックし、オフなら上記“1”へ進み、オンならステップＳ１３１に進んでそのままメインフローを続行する。

【００４０】上記ステップＳ１３１では上記ＫＥＹによる割込みの判定が行なわれる。後記各モードスイッチが押されて割り込みが発生すれば、図7の“3”に飛び、割込みがなければステップＳ１３２に進む。

【００４１】上記ステップＳ１３２ではLCDパネル１０２に何らかの情報が表示中か否かをチェックし、表示中でなければステップＳ１３３に進んで各操作スイッチBK，RW等のＫＥＹの割り込みを許可してストップモード状態となる。上記ステップＳ１３２でＬＣＤパネル１０２が表示中なら図5の“2”へ戻る。

【００４２】なお、ステップＳ１１７，ステップＳ１３１，ステップＳ１３３におけるＫＥＹとは、図4に示すスイッチ操作部１０３中のスイッチを意味する。

【００４３】次に、上記ＫＥＹ割り込みの処理のサブルーチンを図7を参照して説明する。

【００４４】上記ステップＳＳ１３１（図6参照）でＫＥＹ割込みがあれば図7のステップＳ１４１に進んでＬＣDパネル１０２（図4参照）をオンする。この後、ステップＳ１４３に進んで1段目のレリーズスイッチ１Ｒが押されているか否かをチェックする。この1段目のレリーズスイッチ１Ｒが押されていれば、ステップＳ１４４においてレリーズ処理を行った後、図5の“1”へ戻る。上記ステップＳ１４３で１段目のレリーズスイッチ１Ｒがオフならステップ S１４６へ進み、ズームアップまたはズームダウンの指示がなされていればステップＳ１５８へ進む。このステップＳ１５８ではＬＣＤパネル１０２が表示中か否かをチェックし、表示中であれば、図5の“2”へ、また、表示中でなければ図6の“4”へ戻る。

【００４５】上記ステップＳ１４６において、ズームアップまたはズームダウンの指示があったときはステップＳ１４７へ進んでズーム処理がなされる。

【００４６】次に、上記図5のステップＳ１１３における、ズームレンズを沈胴位置から撮影可能なワイド端位置へ移動させるステップを、図8のフローチャートおよび図１０を参照してさらに詳しく説明する。

【００４７】ステップＳ３０１において、ズームモータ３１（図4参照）を正転させた後、ステップＳ３０２で上記フォトリフレクタ１１（ＺＰＲ、図4参照）の出力信号をA／D変換する。この後、ステップＳ３０３において、該A／D変換値より所定のしきい値＃ＴＨ１を減算する。

【００４８】この後、ステップＳ３０４において、上記ステップＳ３０３における比較値を判断（ＣＹ）し、ボローがでなければ上記A／D値は上記しきい値＃ＴＨ１より高い、すなわちフォトリフレクタ１１の出力信号は“H”レベルと判断してステップＳ３０２へもどる。上記A／D値がしきい値＃ＴＨ１より低くなればフォトリフレクタ１１の出力信号が“L”レベルになったと判断しステップＳ３０５へ進む。

【００４９】このステップＳ３０５で、ズームレンズの現在値を示すＣＰＵ１０１内部のRAM上のＺＭＰＬＳをリセットした後、ステップＳ３０６で、上記フォトインタラプタ３４（ＺＰＩ、図4参照）の出力値をチェックして（ＺＰＩＨＲＤ）、立上りエッチがあったとき、上記ＺＭＰＬＳを＋１する。

【００５０】この後、ステップＳ３０７で、ズームレンズの現在値ＺＭＰＬＳからワイド端位置を示す値＃ＷＩＤＥを減算して、ステップＳ３０８において比較値を判断（ＣＹ）し、ボローがあればまだワイド端位置でないので上記ステップＳ３０６へもどり、ボローがなければワイド端位置なのでステップＳ３０９へ進む。

【００５１】このステップＳ３０９では、ズームモータ３１にブレーキをかけ（ＺＭＯＴＢＫ）、ステップＳ３１０において一定時間待機した後（ＴＩ）、ステップＳ３１１においてズームモータ３１を停止させてメインルーチンにもどる（ステップＳ３１２）。

【００５２】次に、上記ステップＳ１４７におけるズーム処理について図9のフローチャートを参照して説明する。

【００５３】ステップＳＳ５０１では、ズームモータ駆動に必要なＣＰＵ１０１（図4参照）のポート初期化、およびＩＦＩＣ１１１の起動を行う。この後、ステップＳ５０２において、ズームモータ３１（図4参照）の駆動方向を示すフラグＺＵＤＦを見て該フラグＺＵＤＦ＝１ならばズームモータ３１を正転させるようステップＳ５０４へ進む。上記ステップＳ５０２においてフラグＺＵＤＦ＝０のときは、該ズームモータ３１を逆転させるようにステップＳＳ５０３へ進む。

【００５４】この後、ステップＳ５１１において、ズームスイッチＺＳＷ、すなわち、前記ズームアップ用スイッチＺ－ＵＰとズームダウン用スイッチＺ－ＤＯＷＮとの何れかがオンされたか否かをチェック（ＣＫ）し、該ズームスイッチＺＳＷが何れもオフならばステップＳ５１６へ進む。

【００５５】上記ステップＳ５１１でズームアップ用スイッチＺ－ＵＰとズームダウン用スイッチＺ－ＤＯＷＮとの何れかがオンされているときは、ステップＳ５１２へ進む。

【0056】このステップS512では、ズームレンズの現在値を示す上記ZMPLSによりズーム位置がワイド端位置あるいはテレ端位置になったかを判定し、ワイド端位置，テレ端位置のどちらかになった所で、上記ズームモータ31を停止すべくステップS516へ進む。また、上記ステップS512で、ズームレンズ位置がワイド端位置あるいはテレ端位置に達していないときは、次にステップS513に進む。

【0057】このステップS513では、通常のズーム動作中は、上記フォトリフレクタ11（ZPR）の出力信号は“L”レベルであるが、ズーム駆動中に“H”レベルになったときは、誤カウントと判断して上記ZMPLSをリセットする。また、ズームダウン中に該フォトリフレクタ11（ZPR）の出力信号が“H”レベルになったときは、ズームモータ31を正転させ、上述したズーム処理を行えば、リセットできる。また、ズームアップのときは該フォトリフレクタ11（ZPRが）の出力信号がしきい値＃TH2（図11参照）を越えて“H”レベルになった所でテレ端位置を示す値＃TELE分のパルスをカウントし、上記ZMPLSをテレ端位置に相当するパルス数にリセットする。

【0058】この後、ステップS514でフォトインタラプタ34（ZPI）の検出用タイマをスタートさせ、ステップS515で、該フォトインタラプタ34のパルス立上りをチェックして上記ZMPLSをカウントアップもしくはカウントダウンする。ここで、一定時間内に該フォトインタラプタ34の立上りがなければズームモータ31あるいはズームエンコーダ10の故障と判断して、ステップS521の異常処理（DAMAG）へ行く。

【0059】上記ステップS516は、上記フラグZUDFを判断してZUDF＝0ならばステップS517へ進む。

【0060】このステップS517は、メカを一方向に駆動することでギアのバックラッシ取りを行う。駆動量としてはズームモータ31を正転させてフォトインタラプタ34の立上り1パルスが生じたときに該モータ31を停止する。

【0061】この後、ステップS518で上記ズームモータ31に一定時間ブレーキをかけ（ZMMOTB）、ステップS519で該ズームモータ31を停止させた後、メインルーチンにもどる（ステップS520）。

【0062】図12は、本発明の第2実施例を示したものであって、このズームエンコーダ210は、カメラのズームレンズ鏡筒に適用されている。ズームレンズ駆動用のカム筒からなるカムリング212には、バリエータ等の前群レンズとコンペンセータ等の後群レンズとからなる内蔵ズームレンズ群211を光軸方向に移動するための傾斜カム溝孔213，214が穿設されている。このカム溝孔213，214には、図示されない前群レンズ保持枠と後群レンズ保持枠とにそれぞれ一体に植立されたガイドピン216，217が嵌挿されている。

【0063】上記カムリング212のカメラ本体215がわの基部寄りの外周面には、周方向にリング駆動用のセクタギアー219が一体に設けられており、このセクタギアー219には駆動用ギアー218が噛み合っている。この駆動用ギアー218にはモータ220の出力ギアー221の回転力が減速歯車列222を介して伝達されるようになっている。したがって、上記モータ220が正転または逆転駆動されると、その回転力は減速歯車列222を介して駆動用ギアー218に伝達され、これによってカムリング212が光軸の周りに正方向または逆方向に回転し、上記カム溝孔213，214とガイドピン216，217とにより、前群レンズと後群レンズとの間隔を変えるように前群レンズ保持枠と後群レンズ保持枠とが光軸方向に移動し、これによってズーム撮影レンズのズーミングがなされる。

【0064】また、上記駆動用ギアー218にはパルス発生器223のパルス発生用の回転板224を回転駆動するためのギアー225が噛み合っている。上記パルス発生器223は、円周方向に等間隔であつて放射方向に多数延び出すように形成された透光部と遮光部とが交互に形成された上記回転板224と、この回転板224の一部を挟んで対向して配設された光照射部と受光部とからなるフォトインタラプタ226とで構成されている。このパルス発生器223は上記カムリング212を回転駆動する駆動用ギアー218の回転に連動して回転板224が回転し、フォトインタラプタ226によってカムリング212の回動に応答するパルス信号P，Iを出力する。

【0065】そして、上記カムリング212の外周面の一部には、絶対値エンコーダ用の読取用パターン130が形成されている。この読取用パターン130は、高反射率部の凸部と非反射部の凹部との凹凸形状のパターンで形成されており、本第2実施例ではカムリングそのものの外周面を凸部とし、凹部をカムリングに穿設した穴部で形成している。すなわち、この読取用パターン130は、図13に、その平面形状を拡大して示すように、全体の形状が周方向に横長の長方形からなり、その左方部にL字状に穿設された穴部130aと右方上半部に角穴状に穿設された穴部130bからなる凹部と、中央部に設けられていて、上記穴部130aに対向して逆L字状に形成された高反射率部131aと同高反射率部131aに連設して上記穴部130bに対向する位置に形成された高反射率部131bとからなる凸部とで形成されている。

【0066】このように形成された読取用パターン130に対向する位置、つまりカムリング212の外側であって、上記読取用パターン130に対向する位置には、図12に示すように、フォトリフレクタ132a，13

２ｂが光軸方向に並んで、図示されない不動部材に固定されている。そして、このフォトリフレクタ（Ｐ．Ｒ）１３２ａ，１３２ｂが絶対値エンコーダの出力信号ＰＲ１，ＰＲ２を発生する。

【００６７】すなわち、このフォトリフレクタ１３２ａ，１３２ｂは図１３に示す如く、その出力信号ＰＲ１，ＰＲ２がカムリング２１２の回動とともに、（１．１）→（０．１）→（０．０）→（１．０）と変化する。
ここで、（１．１）と（０．１）の変化点を沈胴位置◎
（０．１）と（０．０）の間をワイド端（広角端）位置◎
（０．１）と（０．０）の変化点をスタンダード位置（Ｓ位置）◎
（０．０）と（１．０）の変化点をテレ端（望遠）位置◎
としてそれぞれ設定してある。なお、本実施例ではズーム倍率が３５ｍｍ～８０ｍｍのズームレンズが使用されているものとし、ワイド端（Ｗ端位置）で３５ｍｍ，テレ端（Ｔ端位置）で８０ｍｍの焦点距離となる。

【００６８】図１４は、上記ズームエンコーダが適用されたカメラの電気回路の要部の構成を示したものである。カメラのズーミング動作および撮影動作をシーケンス制御するＣＰＵ１３３には、パワースイッチＰＷＳＷ，ズームアップ用スイッチＺＵＳＷ，ズームダウン用スイッチＺＤＳＷの各動作信号がそれぞれ入力するようになっており、ＣＰＵ１３３は、これらの信号によってモータドライブ回路１３４を制御して前記駆動モータ２２０の回転を制御する。そして、前記カムリング２１２の回動によって出力されるパルス発生器２２３のパルス信号Ｐ．Ｉ，上記フォトリフレクタ１３２ａ，１３２ｂの出力信号ＰＲ１，ＰＲ２をそれぞれモニタするようになっている。なお、ＥＥＰＲＯＭからなる記憶素子１３５には、ワイド端位置を示すパルス数“１０”およびＳ位置を示すパルス数“４０”が記憶されている。

【００６９】次に、このように構成された本実施例のズームエンコーダを有するズームレンズの動作を、図１５～図１８に示すフローチャートと共に説明する。先ず、カメラのパワースイッチＰＷＳＷがオフされると、ＣＰＵ１３３はこれを検知し、必ずズームレンズを沈胴状態にセットし、カメラ動作を停止する。すなわち図１５に示す沈胴ルーチンについて述べると、レンズ鏡筒における沈胴領域は前記図１３に示したようにフォトリフレクタ１３２ａ，１３２ｂの出力ＰＲ１，ＰＲ２が、ＰＲ１＝１，ＰＲ２＝１の領域である。よって、パワースイッチＰＷＳＷがオフされると、ＣＰＵ１３３はステップＳ１において、モータドライブ回路１３４にズームモータの逆転指令を与え、モータ２２０を逆転させながら入力ポートP.R.1，P.R.2 が共に１となるまで逆転をさせ、これをチェック（ステップＳ２）する。そして、これが共に１となった時点で、モータドライブ回路１３４にモータ停止指令を与え、ズームモータ２２０の回転を停止（ステップＳ３）し、リターンする。これでズームレンズは沈胴位置にセットされる。

【００７０】次に、パワースイッチＰＷＳＷがオンされると、図１６に示すようにパワーオンルーチンが動作し、ＣＰＵ１３３はズーム撮影レンズを沈胴状態からワイド端Ｗ位置である焦点距離３５ｍｍの繰出し位置にセットする。すなわち、パワースイッチＰＷＳＷがオンされると、ＣＰＵ１３３は先ず、モータドライブ回路１３４にズームモータの正転指令（ステップＳ１１）を与え、ズームモータ２２０を正転させながら入力ポートP.R.1，P.R.2 をモニタ（ステップＳ１２）し続ける。そして撮影レンズが出力P.R.1＝１，P.R.2＝１の沈胴状態位置から出力P.R.1＝０，P.R.2＝１となる位置に移動すると、これに同期してＣＰＵ１３３はパルス発生器２２３からのパルス信号Ｐ．Ｉのアップカウントを開始（ステップＳ１３）し、ステップＳ１４で、このカウント値のチェックをする。そして、ＥＥＰＲＯＭ１３５（図１４参照）に書き込まれているワイド端位置を示すパルス数“１０”に達するまで、モータの回転を続行する。予定のパルス数“１０”に達したところで、ズームモータ２２０の回転を停止（ステップＳ１５）させ、リターンする。これでズームレンズは沈胴状態から焦点距離３５ｍｍのワイド端Ｗ位置に設定される。

【００７１】次いで、撮影者がズームアップ用スイッチＺＵＳＷをオンしてズームアップ動作を行うと、図１７に示すＺＵルーチンが作動する。上記スイッチＺＵＳＷをオンすると、先ずテレ端位置（Ｔ端位置）にあるか否かを、ＣＰＵ１３３はフォトリフレクタ１３２ａ，１３２ｂの出力ＰＲ１，ＰＲ２によってチェック（ステップＳ２１）する。テレ端位置（Ｔ端位置）にあれば、ステップＳ２８に移行してズームモータ停止ルーチンにて停止処理を行い、パルス発生器２２３からのパルス信号Ｐ．Ｉのアップカウントを停止（ステップＳ２９）し、リターンする。

【００７２】テレ端位置（Ｔ端位置）になければ、次のステップＳ２２に移行し、パルス信号Ｐ．Ｉのアップカウントを開始する。そして、ステップＳ２３でズームモータ２２０を正転させる。その間、アップカウントを続行しつつ、ＣＰＵ１３３は入力ポートP.R.1，P.R.2 をモニタし、出力ＰＲ１，ＰＲ２の変化（ステップＳ２４）とズームアップ用スイッチＺＵＳＷの状態をモニタ（ステップＳ２５）する。このスイッチＺＵＳＷがオフすれば、すなわち、撮影者が所望のズーム位置を決定すると、ステップＳ２８に飛び、ズームモータ２２０を停止してパルス信号Ｐ．Ｉのアップカウントを停止（ステップＳ２９）し、リターンする。そして、その間に出力ＰＲ１，ＰＲ２の変化（ステップＳ２４）があれば、ステップＳ２６においてＳ位置かＴ端位置かを確認し、Ｔ

端位置であればステップＳ２８に飛び、ズームモータ２２０を停止してパルス信号Ｐ．Ｉのアップカウントを停止（ステップＳ２９）し、リターンする。また、Ｓ位置であれば、ステップＳ２７においてＰ．Ｉのカウント値を“４０”にセットし、ステップＳ２４に戻る。ここでカウント値を上記の値にセットすることはカウント値を更新したことになり、以後のカウント値を正確なものにすることができる。このようにしてズームアップ動作時のエンコーダは動作する。

【００７３】次に、撮影者がズームダウン用スイッチＺＤＳＷを押してズームダウン動作を行うと、図１８に示すＺＤルーチンが動作する。上記スイッチＺＤＳＷをオンすると、ＣＰＵ１３３はそれを検出して、先ず現在のＰ．Ｉのカウント値がワイド端位置のパルス数“１０”以下であるか否かを確認（ステップＳ３１）する。その結果、“１０”以下であれば、ステップＳ３８に飛ぶ。ワイド端でなければ、ズームアップ方向の位置にレンズがあるので、レンズをズームダウン方向に移動させる。すなわち、Ｐ．Ｉのダウンカウントを開始（ステップＳ３２）させ、ズームモータ２２０を逆転（ステップＳ３３）させる。その間、ダウンカウントを続行させつつ、出力ＰＲ１，ＰＲ２の変化（ステップＳ３４）とズームダウン用スイッチＺＤＳＷの状態をモニタ（ステップＳ３７）する。そして、撮影者が所望するズーム位置にレンズが移動すると、スイッチＺＤＳＷがオフされる。このズームダウン用スイッチＺＤＳＷがオフすると、ギアーのバックラッシ取りのためにズームモータ２２０を正転（ステップＳ３８）させ、Ｐ．Ｉのアップカウント（ステップＳ３９）を行い、所定アップカウント（ステップＳ４０）、例えば2アップカウント後、ズームモータ２２０を停止（ステップＳ４１）してパルス信号Ｐ．Ｉのカウントを停止（ステップＳ４２）させ、Ｐ．Ｉのカウンタからバックラッシ分の1カウントを減算（ステップＳ４３）し、リターンする。また、ステップＳ３７において、スイッチＺＤＳＷがオンしておれば、ステップＳ３４に戻るループをとる。

【００７４】一方、ステップＳ３４において出力ＰＲ１，ＰＲ２の変化があれば、次にステップＳ３５で、Ｓ位置か否かのチェックが行われ、Ｓ位置であればステップＳ３６において、Ｐ．Ｉのカウントを Ｓ位置を示す“４０＋（バックラッシ分１）＝４１”にセットし、ステップＳ３１に戻る。このようにカウント値を上記の値にセットすることはカウント値を更新したことになり、以後のカウント値を正確なものにする。このようにしてズームダウン動作時のエンコーダは動作する。

【００７５】

【発明の効果】以上述べたように本発明によれば、構成の大型化，並びにコストアップを招くことなく、相対値エンコーダのもつ原理的な欠点であるミスカウントも、ズームのアップ／ダウン操作途上にて自動的に修正されるため、信頼性の著しく向上した相対値非接触型のズームエンコーダを提供することができる。

【図面の簡単な説明】

【図１】本発明のズームエンコーダの概念図。

【図２】本発明の第１実施例を示すズームエンコーダの斜視図。

【図３】上記第1実施例におけるフォトリフレクタの読取用パターンとフォトリフレクタ出力との関係を示す線図。

【図４】上記第1実施例のズームエンコーダの要部の電気回路のブロック構成図。

【図５】上記第1実施例が適用されるズームカメラに電源を投入したときの、パワーオンリセット時のサブルーチンを示すフローチャート。

【図６】上記第1実施例が適用されるズームカメラの、スタンバイ解除時のサブルーチンを示すフローチャート。

【図７】上記第1実施例が適用されるズームカメラにおけるスイッチ操作よる割り込み処理のサブルーチン示すフローチャート。

【図８】上記第1実施例が適用されるズームカメラにおいて、ズームレンズが沈胴位置から撮影可能なワイド端位置へ移動される際の動作を示すフローチャート。

【図９】上記第1実施例が適用されるズームカメラにおける、ズーム処理を示すフローチャート。

【図１０】上記第1実施例が適用されるズームカメラにおいて、ズームレンズが沈胴位置から撮影可能なワイド端位置へ移動される際の、ズームモータとズームフォトリフレクタおよびズームフォトインタラプタの出力信号との関係を示したタイムチャート。

【図１１】上記第1実施例が適用されるズームカメラにおいて、ズームレンズが沈胴位置から撮影可能なテレ端位置へ移動される際の、ズームモータとズームフォトリフレクタおよびズームフォトインタラプタの出力信号との関係を示したタイムチャート。

【図１２】本発明の第２実施例を示すズームエンコーダの斜視図。

【図１３】上記第2実施例におけるフォトリフレクタの読取用パターンとフォトリフレクタ出力との関係を示す線図。

【図１４】上記第2実施例のズームエンコーダの要部の電気回路のブロック構成図。

【図１５】上記第2実施例が適用されるズームカメラにおけるズームレンズの沈胴ルーチンのプログラムのフローチャート。

【図１６】上記第2実施例が適用されるズームカメラのパワースイッチをオンしたときのパワーオンルーチンのプログラムのフローチャート。

【図１７】上記第2実施例が適用されるズームカメラのズームアップスイッチをオンしたときのＺＵルーチンの

プログラムのフローチャート。

【図18】上記第2実施例が適用されるズームカメラのズームダウンスイッチをオンしたときのZDルーチンのプログラムのフローチャート。

【符号の説明】

1…ズーム駆動手段

2…非接触型パルス発生手段

3…パルスカウント手段

4…ズーム所定位置検出手段

5…カウント値更新手段

10…ズームエンコーダ

11…ズームフォトリフレクタ

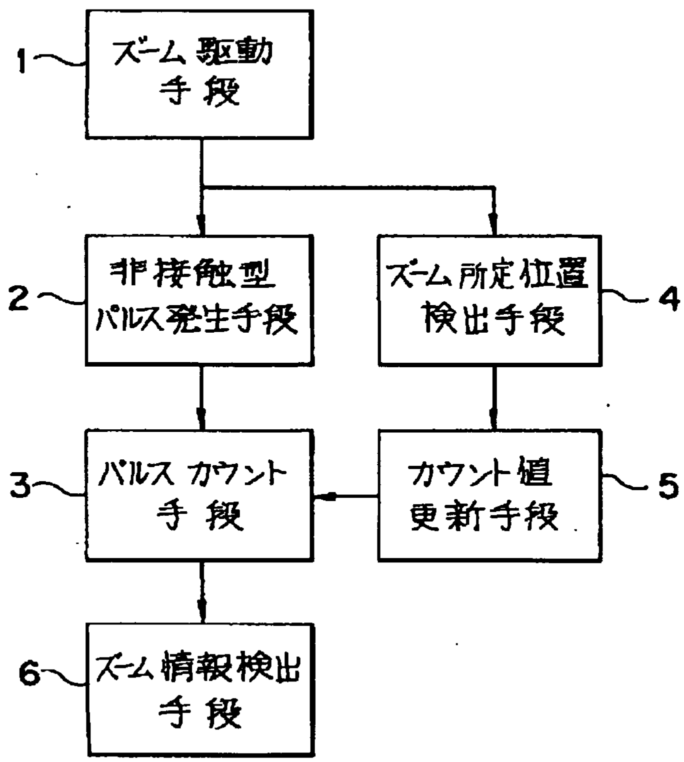
20…回転環

30…ズームモータ駆動ユニット

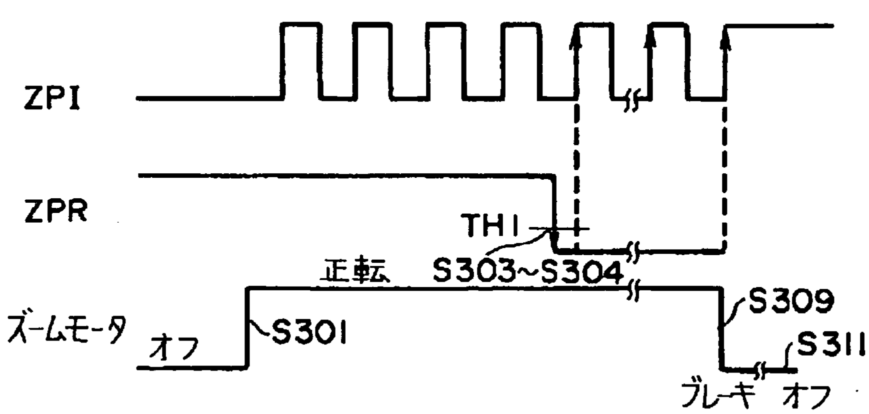
31…ズームモータ

34…ズームフォトインタラプタ

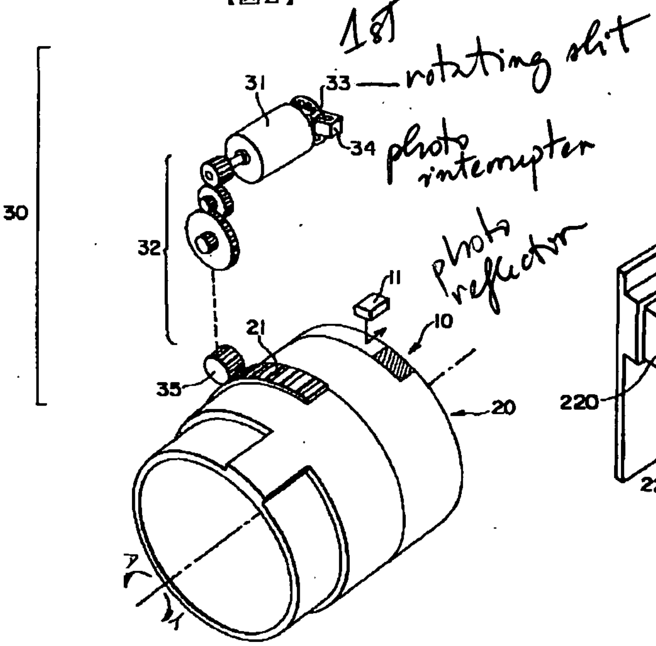
【図1】



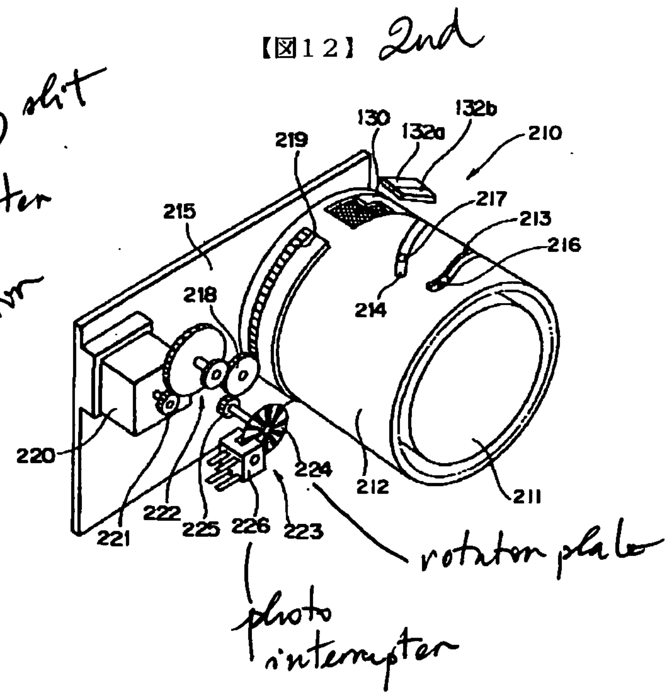
【図10】



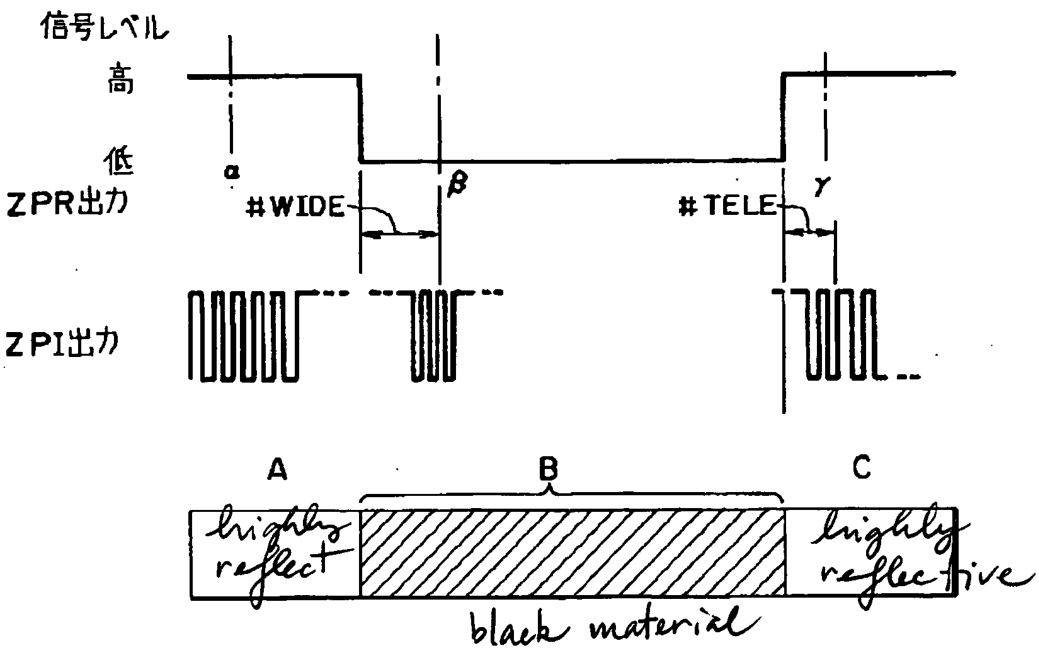
【図2】 1st



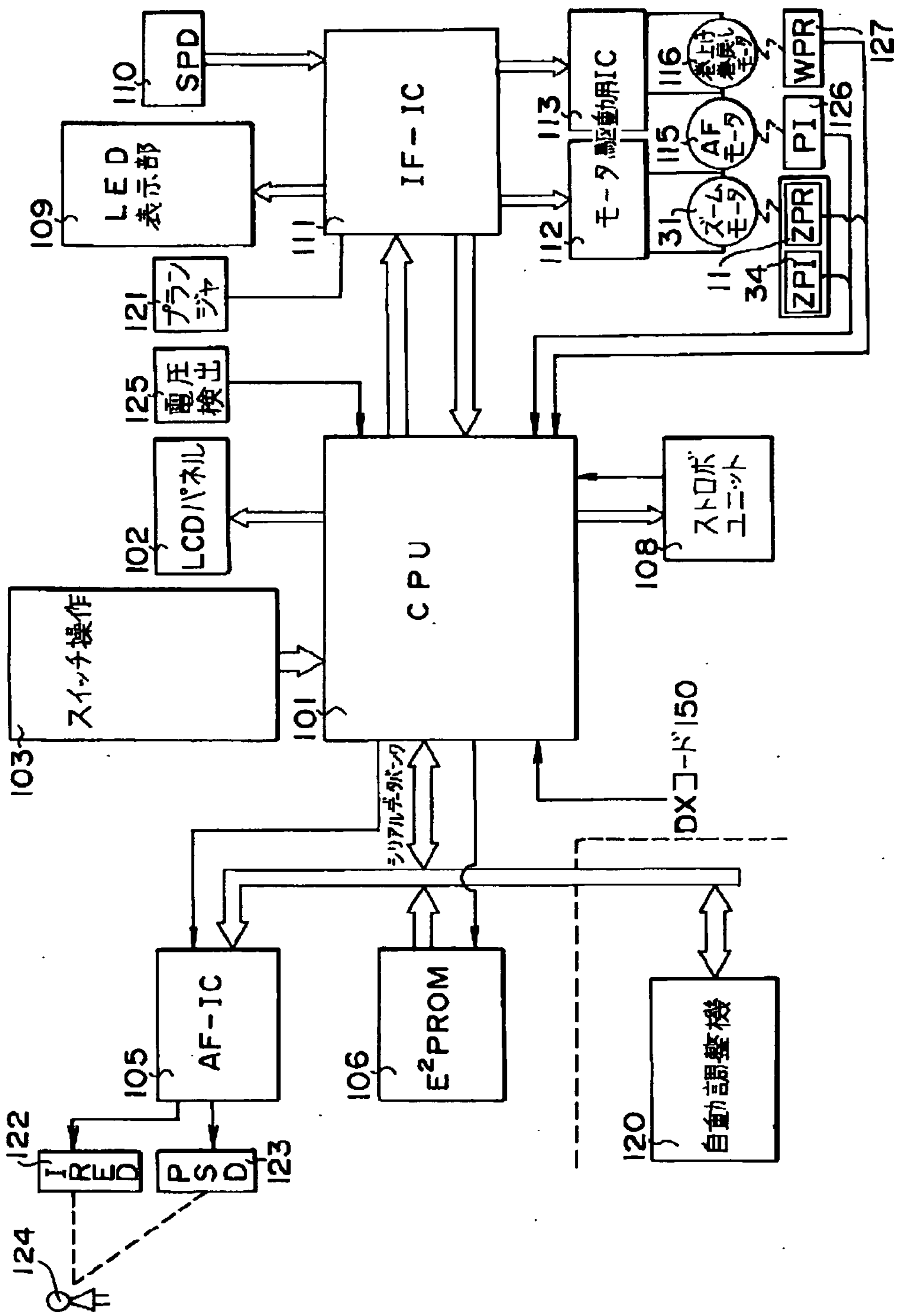
【図12】 2nd



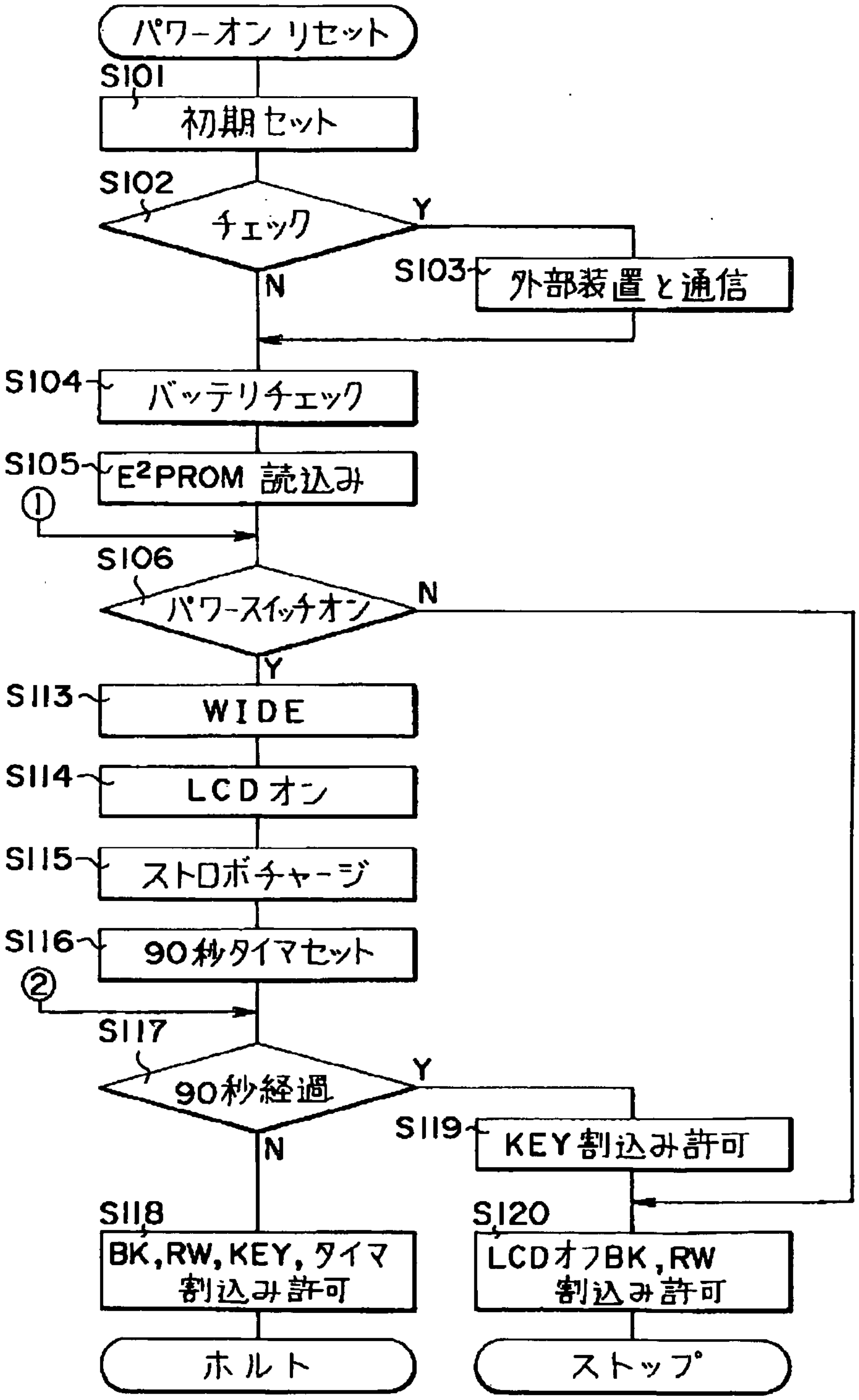
【図3】 1st



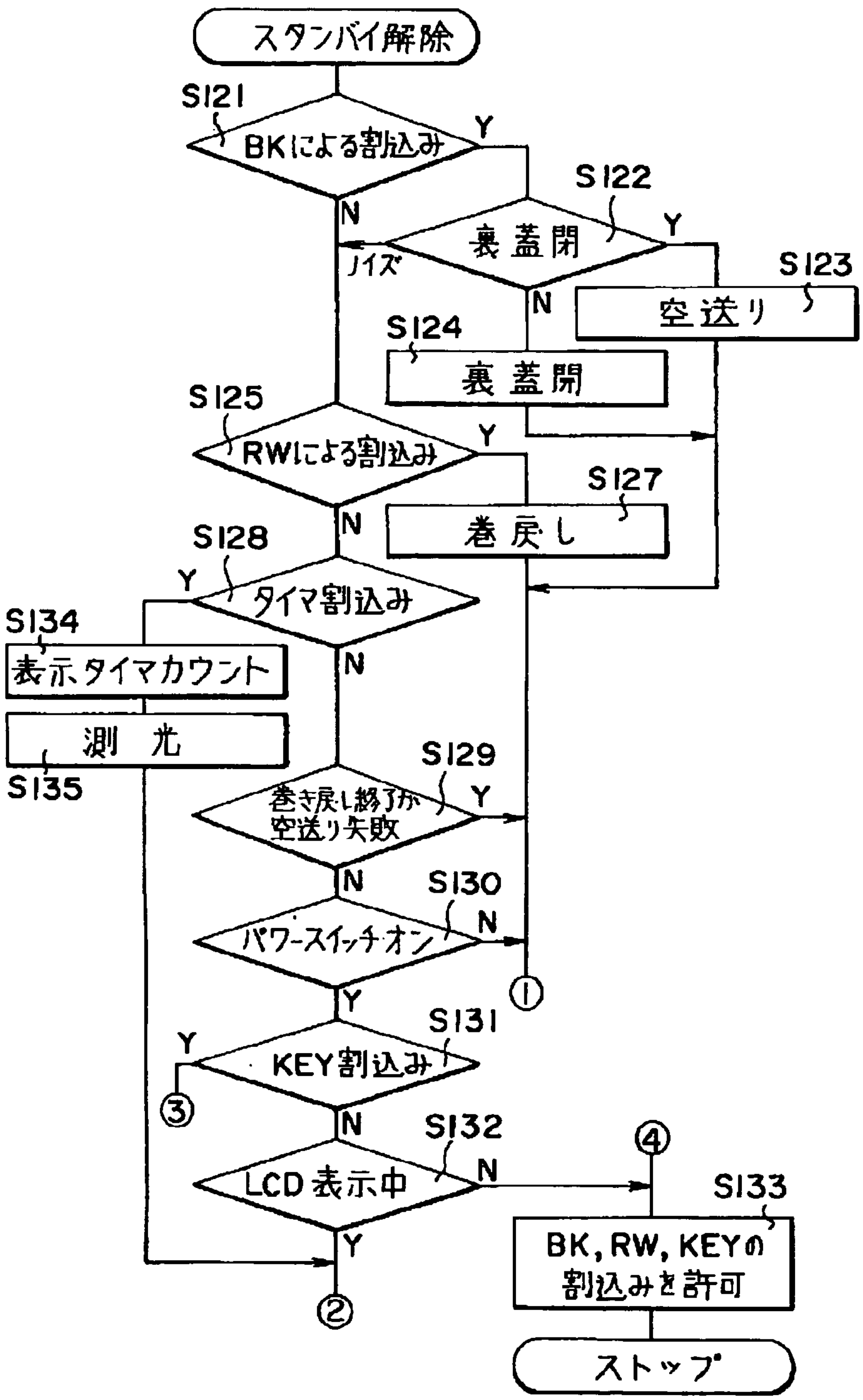
【図4】


SPD
110
IF－IC
111
LED
表示部
109
モータ駆動用IC
112
113
巻上げ巻戻しモータ
116
AFモータ
115
ズームモータ
31
11
WPR
127
PI
126
ZPR
ZPI
34
プランジャ
121
電圧検出
125
LCDパネル
102
CPU
101
ストロボユニット
108
スイッチ操作
103
DXコード150
シリアルデータバス
AF－IC
105
E²PROM
106
自動調整機
120
IRED
122
PSD
123
124

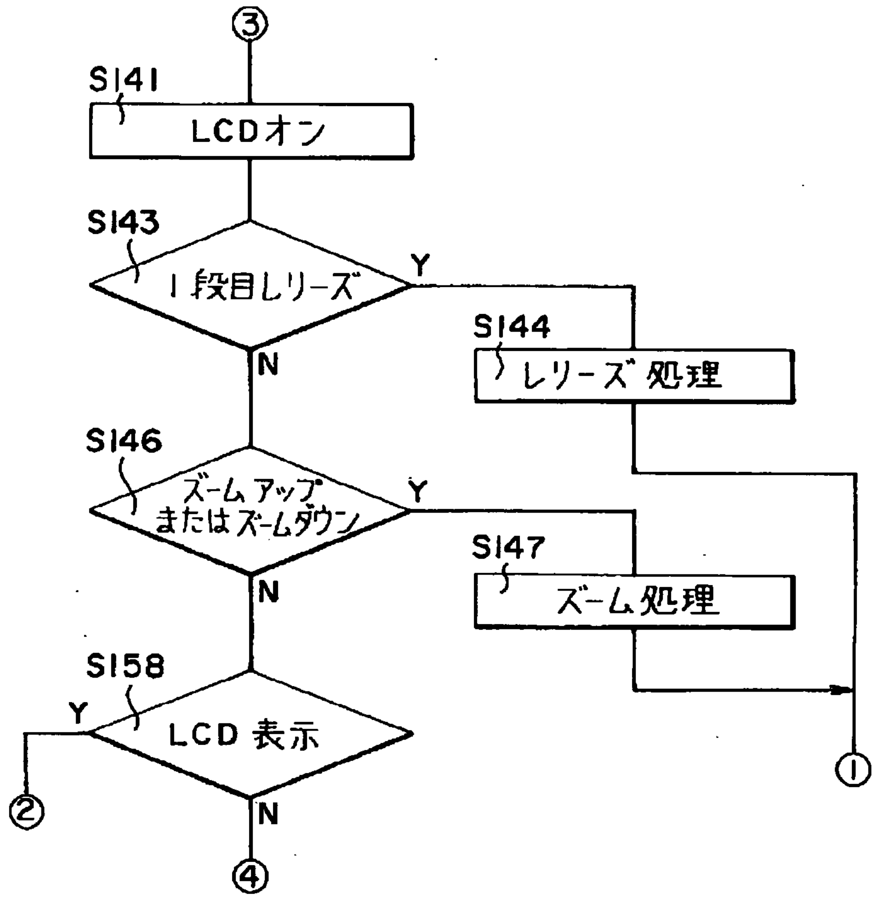
【図5】


パワーオン リセット
S101
初期セット
S102
チェック
Y
N
S103
外部装置と通信
S104
バッテリチェック
S105
E²PROM 読込み
①
S106
パワースイッチオン
N
Y
S113
WIDE
S114
LCDオン
S115
ストロボチャージ
S116
90秒タイマセット
②
S117
90秒経過
Y
N
S119
KEY割込み許可
S118
BK,RW,KEY,タイマ 割込み許可
S120
LCDオフBK,RW 割込み許可
ホルト
ストップ

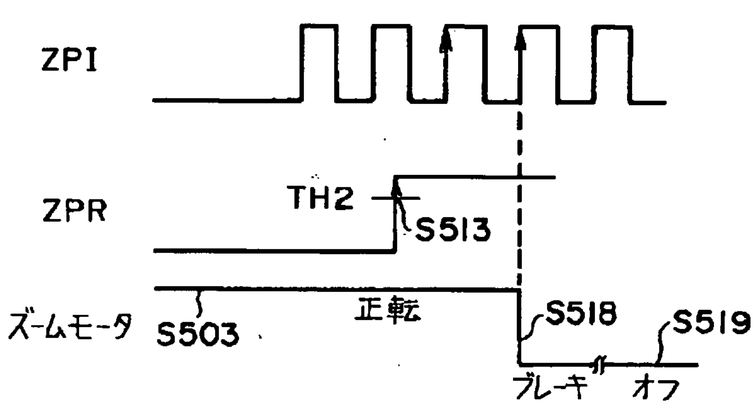
【図6】


スタンバイ解除
S121
BKによる割込み
Y
N
S122
裏蓋閉
Y
ノイズ
N
S123
空送り
S124
裏蓋閉
S125
RWによる割込み
Y
N
S127
巻戻し
S128
タイマ割込み
Y
N
S134
表示タイマカウント
測光
S135
S129
巻き戻し終了か
空送り失敗
Y
N
S130
パワースイッチオン
N
Y
①
S131
KEY割込み
Y
③
N
S132
LCD表示中
N
④
S133
BK, RW, KEYの
割込みを許可
Y
②
ストップ

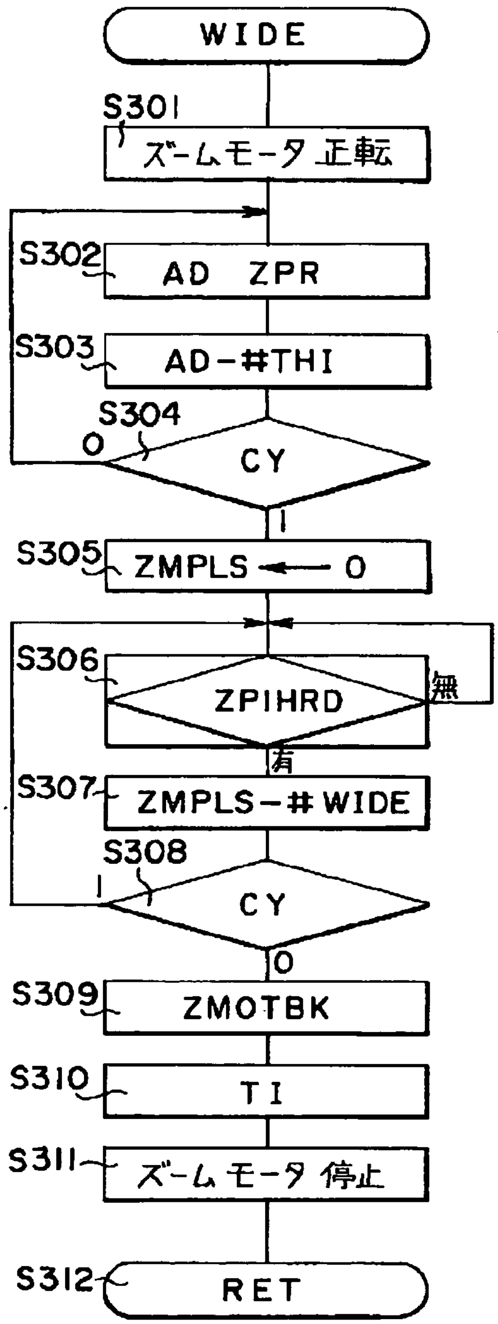
【図7】


③
S141
LCDオン
S143
1段目レリーズ
Y
N
S144
レリーズ処理
S146
ズームアップまたはズームダウン
Y
N
S147
ズーム処理
S158
LCD表示
Y
N
②
④
①

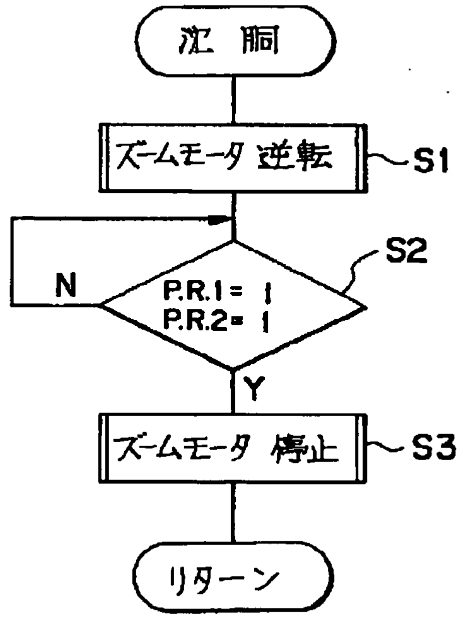
【図11】


ZPI
ZPR
TH2
S513
ズームモータ
S503
正転
S518
S519
ブレーキ
オフ

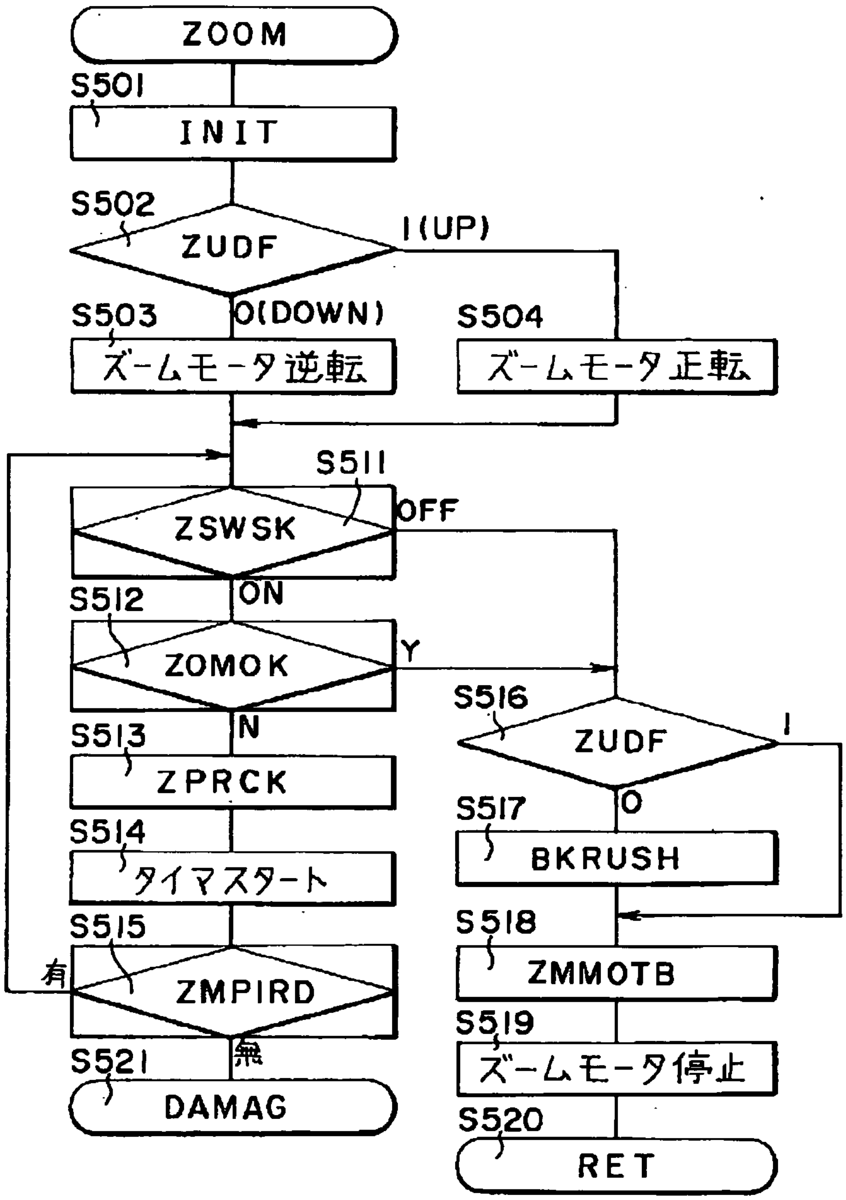
【図8】


WIDE
S301
ズームモータ正転
S302
AD　ZPR
S303
AD－#THI
S304
0
CY
1
S305
ZMPLS ← 0
S306
ZPIHRD
無
有
S307
ZMPLS－#WIDE
S308
1
CY
0
S309
ZMOTBK
S310
TI
S311
ズームモータ停止
S312
RET

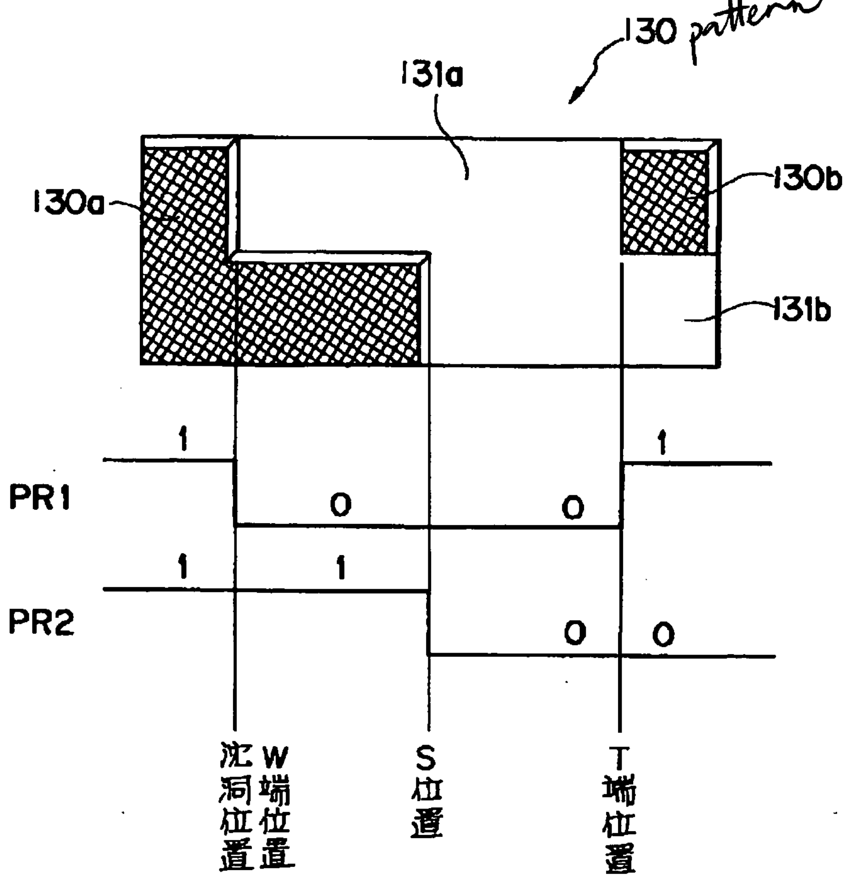
【図15】


沈胴
ズームモータ逆転
S1
N
P.R.1＝1
P.R.2＝1
S2
Y
ズームモータ停止
S3
リターン

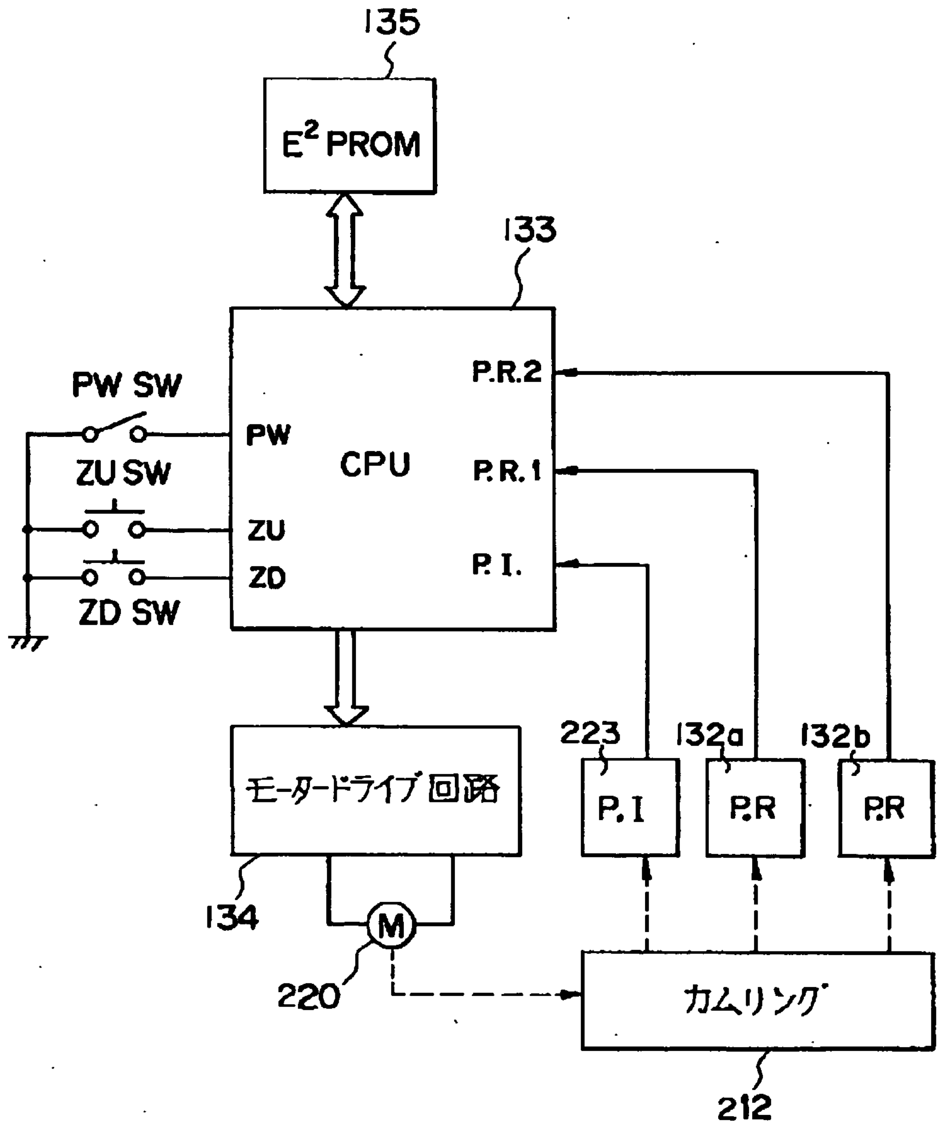
【図9】


ZOOM
S501
INIT
S502
ZUDF
1(UP)
0(DOWN)
S503
ズームモータ逆転
S504
ズームモータ正転
S511
ZSWSK
OFF
ON
S512
ZOMOK
Y
N
S513
ZPRCK
S514
タイマスタート
S515
ZMPIRD
有
無
S521
DAMAG
S516
ZUDF
1
0
S517
BKRUSH
S518
ZMMOTB
S519
ズームモータ停止
S520
RET

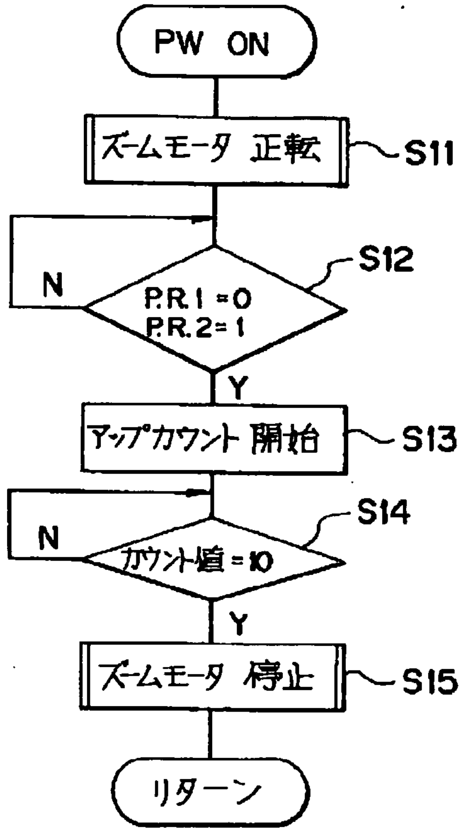
【図13】 2nd


130 pattern
131a
130a
130b
131b
1
0
0
1
PR1
1
1
PR2
0
0
沈洞位置
W端位置
S位置
T端位置

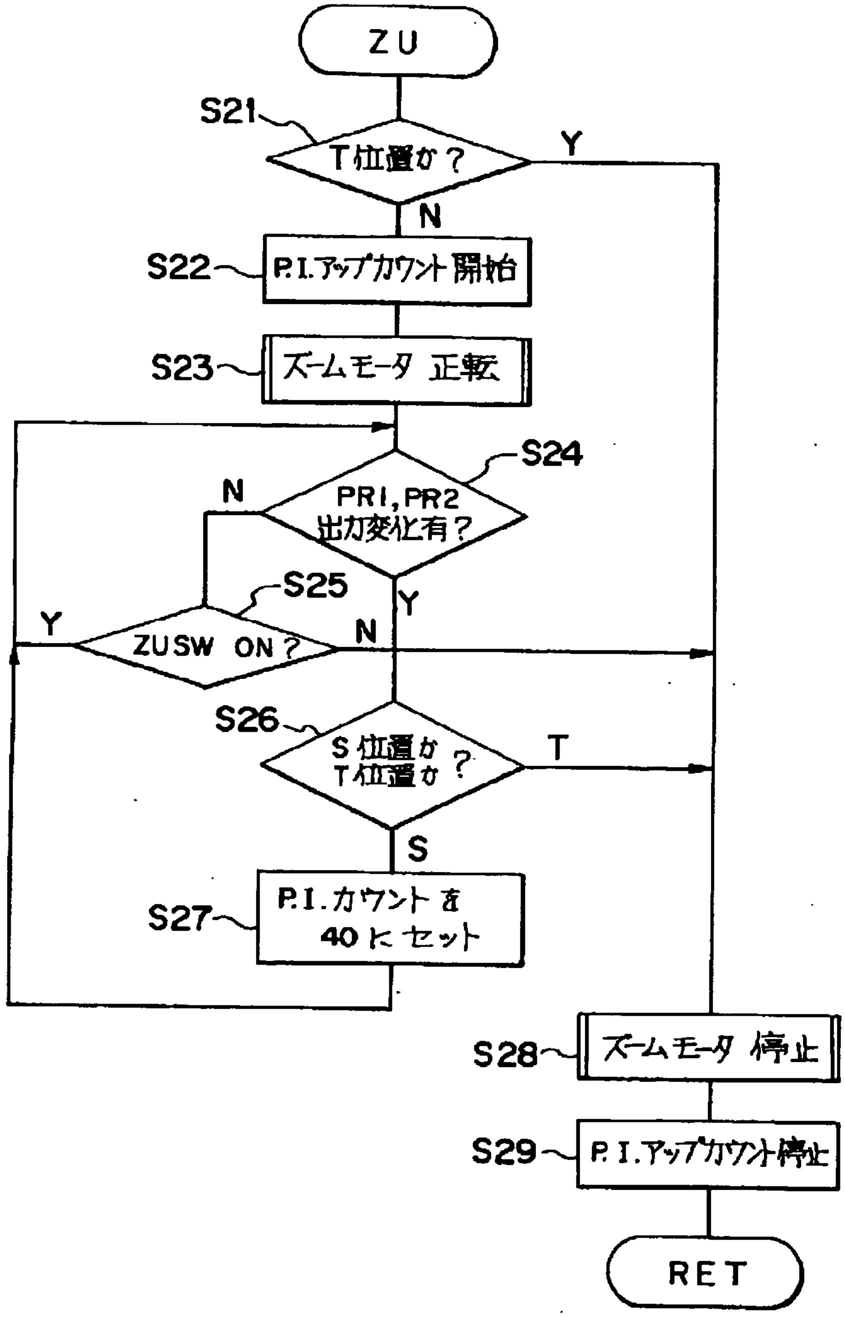
【図14】


135
E² PROM
133
CPU
PW SW
PW
ZU SW
ZU
ZD
ZD SW
P.R.2
P.R.1
P.I.
モーター ドライブ 回路
134
M
220
223
P.I
132a
P.R
132b
P.R
カムリング
212

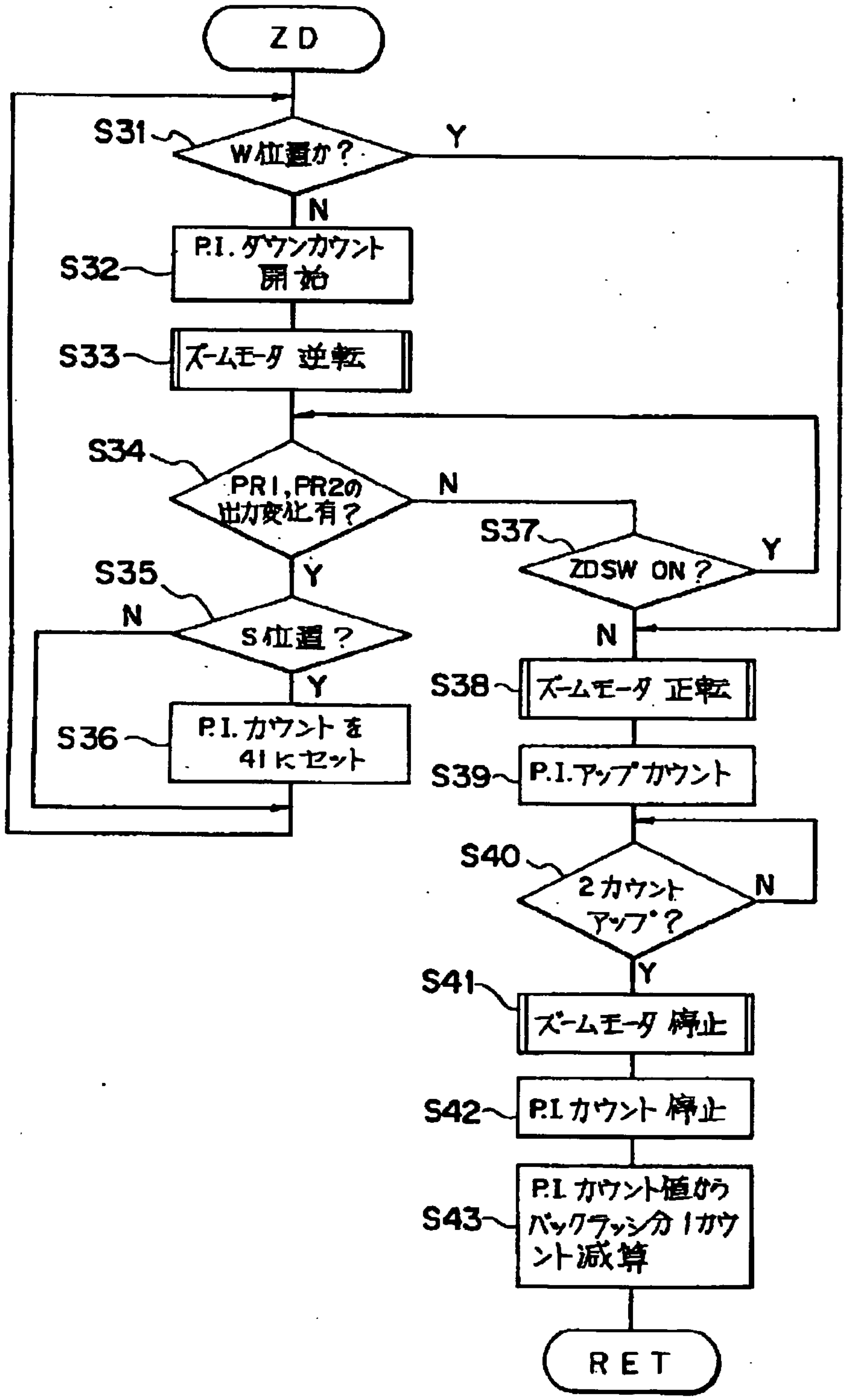
【図16】


PW ON
ズームモータ 正転
S11
S12
N
P.R.1 =0
P.R.2=1
Y
アップカウント 開始
S13
S14
N
カウント値=10
Y
ズームモータ 停止
S15
リターン

【図17】


ZU
S21
T位置か？
Y
N
S22
P.I.アップカウント開始
S23
ズームモータ 正転
S24
N
PR1,PR2
出力変化有？
S25
Y
Y
ZUSW ON？
N
S26
S位置か
T位置か？
T
S
S27
P.I.カウントを
40にセット
S28
ズームモータ 停止
S29
P.I.アップカウント停止
RET

【図18】


ZD
S31
W位置か？
Y
N
S32
P.I.ダウンカウント開始
S33
ズームモータ逆転
S34
PR1,PR2の出力変化有？
N
S37
ZDSW ON？
Y
S35
S位置？
Y
N
S36
P.I.カウントを41にセット
S38
ズームモータ正転
S39
P.I.アップカウント
S40
2カウントアップ？
S41
ズームモータ停止
S42
P.I.カウント停止
S43
P.I.カウント値からバックラッシ分1カウント減算
RET

【手続補正書】
【提出日】平成4年10月2日
【手続補正1】
【補正対象書類名】明細書
【補正対象項目名】0056
【補正方法】変更
【補正内容】
【0056】このステップＳ５１２では、ズームレンズの現在値を示す上記ＺＭＰＬＳによりズーム位置がワイド端位置あるいはテレ端位置になったかを判定し、ワイド端位置，テレ端位置のどちらかになった所で、上記ズームモータ３１を停止しステップＳ５１６へ進む。また、上記ステップＳ５１２で、ズームレンズ位置がワイド端位置あるいはテレ端位置に達していないときは、次にステップＳ５１３に進む。
【手続補正2】
【補正対象書類名】明細書
【補正対象項目名】0058
【補正方法】変更
【補正内容】
【0058】この後、ステップＳ５１４でフォトインタラプタ３４（ＺＰＩ）の検出用タイマをスタートさせ、ステップＳ５１５で、該フォトインタラプタ３４のパルス立上りをチェックして上記ＺＭＰＬＳをカウントアップもしくはカウントダウンする。ここで、一定時間内に該フォトインタラプタ３４の立上りがなければズームモータ３１あるいはズームエンコーダ１０の故障と判断して、ステップＳ５２１の異常処理（ＤＡＭＡＧ）へ行く。ＺＭＰＬＳがズームアップのときテレ端，ズームダウンのときワイド端の場合もＳ５１１へ進む。